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A TELEPHONIC GAUGER.

Unexpected uses of every-day instruments are not infrequently announced. One such application comes to us on the authority of the United States consul at Frankfort, Germany. It is to the effect that an ingenious Frenchman has made use of the telephone receiver to detect adulteration of wine. At first thought this seems rather improbable, but there may be something in it. Undoubtedly, the inventor has adapted Kohlrausch's method for measuring the conductivity of solutions to determine the relative conductivity of a standard sample of wine and that of the sample to be judged. It would seem that the indications of the instrument have a relative value only, for pure wines from different localities would surely give different settings of the instrument although the same standard sample be used; this would, of course, limit the usefulness of the device. Moreover, as soon as a man who adulterates his wine learns that it will be tested in this way, he will find some way of bringing the conductivity up to the standard. To prevent this, other tests will be necessary. Used in connection with other methods of judging wine, the device will probably be useful, but one need hardly expect the telephonic wine-taster to throw out of work the entire class of experts which now makes a living by judging wines.

OVERHEAD CONSTRUCTION FOR ELECTRIC RAILWAYS.

The two interesting papers read at the recent meeting of the American Institute of Electrical Engineers describe the types of overhead construction developed primarily for use with alternating, single-phase systems. The most marked change in the new construction from the old is the use of messenger cables, from which the working conductor is suspended. This reduces the sag of the working conductor, though it was not with this object primarily that the messenger cable was employed. Its great advantage is in the greater flexibility of the working conductor when it is suspended from the cable. With the old construction, even when a flexible support of some kind is employed, such as a span across the track or a short span supported from a bracket, there is more or less of a blow when the collecting device passes the point of support. While this causes sparking, its chief disadvantage is the risk that the collecting device may be thrown off the wire at these points when the car is moving at high speed.

Another advantage of the messenger cable is the greater security which it gives. With the higher voltages which are now to be used on alternating-current systems, the risk of having the wire break must be as low as possible. Moreover, as the roads on which such construction will be used are expected to become important lines, it is essential that dangers of interruption due to a break in the overhead system should be made small. Such constructions as are described in the papers are expensive as compared with the older and simpler method, but there can be no doubt that they show progress in the right direction, and that the additional investment required will be well expended.

One of the difficulties brought in by the use of higher voltage is that of insulating the conductor. As a rule, materials which have good insulating properties are mechanically poor. There are some exceptions to this rule, but they are expensive. The use of a messenger cable simplifies the problem by making double insulation possible and by reducing mechanical strain. The point made by Mr. G. A. Damon in this connection, that hardwood is likely to return into favor, is interesting. It would seem from the discussion that European engineers agree with this conclusion.

It is not likely that any system which has been described will remain unaltered, for we have had, as yet, too little experience with them. But the move to secure a better and stronger overhead system is surely in the right direction.

TELEPHONE GROWTH.

Although statistics are usually dull reading, figures showing the development of certain industries are interesting when this development is beyond the ordinary, or when the industry is closely identified with our every-day life. Figures showing the development of the telephone industry are interesting from both these points of view, for there has probably never been any invention which has become so widely used in so short a time.

About the first of the year some statistics were published, showing the increase in the use of the telephone for certain sections of this country. At that time complete statistics covering the entire country for the year just closed were not available. In the annual report of the president of the American Telephone and Telegraph Company for the year 1904 some figures are given which show how this great company has grown. These figures convey some idea of the enormous amount of work which has been done. For instance, this company had, at the end of last year, 1,950,000 subscribers. It had in use 3,549,810 miles of wire, and transmitted daily 11,149,063 messages. The total for the year was 3,589,998,000. This one company furnishes means by which 11,000,000 talks per day are conducted. How did people ever manage to get along before the telephone was introduced? Did they write more, or did they talk less? In either case, they surely did not accomplish as much as the average man of to-day.

The figures which were published the first of the year showed that, according to the latest statistics, there was one telephone in Great Britain for every 150 inhabitants only; one in Germany for every 121 inhabitants, and one in France for every 358 inhabitants. The Bell company alone in America has one telephone for every forty-two individuals of the entire country, and in comparing these figures it should be borne in mind that the Bell company is not alone in the field. In spite of the much greater development in this country, the telephone is being introduced at continually increasing rates. What the end will be no one can see. The ideal, of course, will not be attained until every individual has a telephone at his elbow.

WIRELESS TELEGRAPHY FOR POLAR TRIPS.

Wireless telegraphy is to be used by Commander Peary during the polar trip upon which he expects to start early next July. By this means the explorer's party hopes to be able to communicate with New York.

This is a practical and useful application of wireless telegraphy. If we are to continue making polar expeditions, it is important that the loss of life and the danger to the explorers should be reduced as much as possible. Many deaths have occurred in the Arctic regions which would have been prevented had means been at hand for communicating with other parties or ships and asking for assistance. It is important not only that the exploring vessel itself keep in touch with the world, but that, if practicable, the party of men which makes the dash for the pole should keep in touch with the vessel. If this can be done much of the uncertainty of Arctic exploration will be removed. The exploring party will push forward with greater confidence, and will be able to go further, because those on the vessel will know at all times where the party is and where to send additional supplies. It would be an interesting climax of such an expedition if the first work done at the pole were to erect a wireless telegraph mast—we almost said, make use of the pole itself for this purpose.

ELECTRIC FURNACES.

During the discussion provoked by Dr. Paul L. T. Héroult's interesting account of his work with the electric furnace in making steel, he laid emphasis upon the necessity for making a furnace of a practical type. A furnace which prevents any contamination of the metal from the carbons is essential for the production of high-grade steels, but such a furnace will not be satisfactory unless it, at the same time, is so constructed that the molten metal can be worked. For instance, Dr. Héroult said that the induction type of furnace, in which a ring of molten metal forms the secondary of a transformer, while very pretty theoretically, is practically a bad design, because, with such a ring of metal, it is impossible to obtain a uniform mixture and to rake off the slag easily. Another objection to this type, he thought, was the large surface from which heat might be lost by radiation and conduction. This would lower the efficiency of the furnace. In his opinion, the simplest form of furnace is the best. A hollow vessel of a more or less spherical form, containing the molten material, is the most advantageous shape so far as regulating the product and economizing the heat are concerned. This type being determined upon, it is then necessary to use such methods of heating as will prevent the metal from taking up the carbon of the electrodes. The thermal efficiency of a furnace of this type can be easily made eighty per cent. No doubt it could be made higher if desirable.

This opinion of a recognized expert will undoubtedly have considerable weight. No one to-day is expecting a revolution in methods of producing iron and steel, but there seems to be no doubt that, by means of the electric furnace, a quality of steel better suited to different purposes can be produced. But before we can expect steel-makers to adopt the new furnace, we must offer them a furnace as convenient as the apparatus in use at present, and one which will produce the desired product cheaply. Convenience, ease of operation, and the ability to produce a uniform product will undoubtedly be controlling factors. The cost of heating electrically, even though it may be considerably more than the cost of heating by fuel, may really be a small matter. What the electric furnace loses in this respect it more than gains in other directions. Nevertheless, it is desirable, of course, to keep this item as low as possible. Hence, other things being equal, the most efficient furnace will be the best. The situation in this line of work is somewhat similar to that in electric railroading. In certain branches of railway work no system other than electricity would be considered, and the great question to-day is how far the new method of propulsion can be extended. The electric furnace enables us to produce materials which can be made in no other way. When such materials are desired, it must be used. But how far the use of the electric furnace can be extended into metallurgical fields is a question which no one to-day can answer.

PROGRESS IN ELECTRIC LIGHTING.

A short while ago the newest form of incandescent lamp—that in which the filament is formed from tantalum wire—was described, and its peculiar characteristics discussed. In the same class should be put the osmium lamp, which has also been referred to from time to time, as progress in its manufacture has been made. The latest information with regard to this lamp was conveyed to the Elektrotechnischer Verein, of Berlin, last January, by Herr Fritz Blau. An abstract of this paper appeared in the issue of the ELECTRICAL REVIEW for March 18. The most interesting point in this paper was the statement that these lamps are now made for 110 volts. About a year ago thirty-seven volts was the limit. This was greatly improved when it was found possible to manufacture the lamps for operation on a fifty-five-volt circuit. Still later, the voltage was raised to seventy-three, and now the very considerable increase to 110 has been accomplished. If the lamps can be manufactured commercially for this voltage, they will at once enter into competition with the ordinary incandescent lamp.

The disadvantages of the osmium lamp are the difficulty of working the metal into the shape of a filament, and the flexibility of the filament when incandescent. Moreover, the material itself is not plentiful, and this is somewhat of a drawback. A thirty-seven-volt, twenty-five-candle-power lamp has a filament 0.087 millimetre in diameter. It is about eleven inches in length, and is thus comparable with that of an incandescent filament. Since the energy consumption per candle is about half that of the incandescent lamp, it follows that the carbon filament must be hotter and "blacker" than the osmium filament—that is to say, it radiates more energy per unit of surface, and the radiations cover a wider range of wave-length. Since the luminous efficiency of an incandescent body increases rapidly with its temperature, it is evident that the higher efficiency of the osmium lamp depends entirely upon its selective radiation.

The dimensions of the filament of the 110-volt osmium lamp are not mentioned in this paper. Assuming the same diameter of filament, and the same energy efficiency, the filament would have to be nine times as long for the higher voltage. This, of course, would be impracticable unless some such method of construction were adopted as has been found necessary for the tantalum lamp. The paper, however, says that it has been possible to reduce the diameter of the filament to 0.03 millimetre. As this is practically one-third the diameter of the filament of the thirty-seven-volt lamp, a filament of this thickness for 110 volts would have practically the same length—that is to say, eleven inches. It is a question whether a filament of this size would be practicable, since even the larger filament has been found weaker than carbon.

As yet, it has not been found possible to draw osmium into wires, and other methods of forming the filament are necessary. This would seem to be a decided disadvantage. It is also probable that in the smaller filaments, at least, and at the high temperatures at which they must be operated, there will be some tendency for the filament to become irregular and draw itself up into drops, on account of the surface tension. This is a phenomenon which is observed in the tantalum lamp, though it is possible that the temperature at which the osmium filament is operated is not sufficient for such action to take place.

While on the subject of improved lamps, it is interesting to note the success which another lamp has attained. The Cooper Hewitt mercury vapor lamp has become universal as the illuminant in the photographic laboratory or other shops where photography plays a considerable part, and is now rapidly making headway as the illuminant for shops, draughting rooms and other large interiors. Its use in this way bears out what was claimed as one of its advantages—that is, the softness of the light, and the less strain thrown by it upon the eyes. When first installed, the peculiar effect of the light is striking, but this soon wears off, and is then no longer noticed. In addition to its high efficiency, the large radiating surface of the lamp gives a very pleasing distribution of light.

THE CONVENIENCE OF THE SMALL MOTOR.

Whichever way one turns in these days of widespread electrical activity, the small motor is seen quietly doing its work at high efficiency and with great reliability and convenience. The store windows of our large cities are full of apparatus silently and steadily operated by an unobtrusive little motor tucked away beneath the shelf, but it is in exhibitions that the full force of these advantages is felt in comparison with the old method of driving apparatus by belting from rigid line shafts, wastefully propelled by belted steam engines and accompanied by an utter lack of flexibility but a plentiful supply of dirt and noise.

An instance of the convenience of the small motor for exhibition purposes was seen in the recently held automobile and power boat show at Boston. Many of the exhibitors desired to illustrate the exact working of the engines, gearing and transmission shafts, reverse levers and clutches of their respective machines. The problem was easily solved by belting a small motor to the mechanism, raising the automobile itself from the floor on a supporting frame or set of blocks and turning on the current. Where the machinery was exposed, either under glass or without covering, the operation was shown with the utmost facility.

Even among the supply exhibits the small motor was kept busy. Sprocket wheels were set up and hung with chains that were kept in motion by a small motor; a special lathe was propelled in a similar way; cyclometers and speed indicators were made to revolve; sign flashes, wheels equipped with different kinds of tires and even lubricator pumps and filters were operated by the same power. Throughout the exhibition it was evident that the ease of installation, compactness, operating safety, simplicity and convenience of the small motor were heartily appreciated, and in the manifold applications of this clean, reliable power the exhibition was full of special suggestion to the central station man, particularly if any kind of a "show" happened to be scheduled for the near future in his own town.

The Murray Type-Printing Telegraph.

In a paper describing his type-printing telegraph, which was read before the Institution of Electrical Engineers, of Great Britain, recently, the inventor, Mr. Donald Murray, discussed certain improvements which are thought to be of much importance.

The principle of the Murray type-printing telegraph is that of preparing, by means of a keyboard resembling that of a typewriter, a punched tape, which is then passed through an automatic transmitter. This reproduces at the receiving station a tape similarly punched, which is then passed through a recorder which prints the message in page form.

One of the improvements dwelt upon is the method by which corrections are made. Errors are eliminated without being recorded on the receiving tape. The following excerpt from Mr. Murray's paper describes the manner in which this is accomplished:

While describing the tape, an important point in regard to automatic printing telegraphs may be explained. So far as commercial telegrams are concerned, a serious objection to direct transmitting page-printing telegraphs is that errors show up badly in the printed message, and operators have to work slowly and carefully to avoid making mistakes. Telegraph operators are remarkably accurate, but, in spite of the best care and skill, errors are frequent. Any one who is accustomed to using a typewriter knows how difficult it is to write a page of typewritten matter without striking at least one or two wrong letters. In four cases out of five there is consciousness of the error as soon as it is made, and steps can be taken to correct it. In tape-printing telegraphs, like the Hughes and Baudot, the errors and the succeeding corrections can be cut out of the tape before it is pasted on to the telegraph blank, and there is then nothing to disfigure the telegram, and make the recipient uneasy about its accuracy. With a direct-transmitting page-printing telegraph this can not be done. A wrong key depressed is an error printed at the other end of the line, and the correction following only magnifies the blot. All automatic systems of telegraphic transmission in which there is preparation of the message beforehand, possess the potentiality of correcting an error before transmission. In the Wheatstone automatic system, for instance, this process is known as a "rub-out." When an operator at a Wheatstone puncher makes a mistake he can pull the tape back and punch it full of holes, thereby obliterating the mistake. In this case the mistake is represented by a series of dots on the received tape, and the transcribing clerk passes over it. In automatic telegraph systems, in which a printing machine takes the place of the receiving operator, it is a comparatively simple matter to arrange that the printer shall imitate the action of the operator by remaining inactive when dots only are coming over the line. In this way no trace of the error appears in the printed message. This, for instance, is done in the Buckingham system. In the Buckingham system, however, as with Morse, the groups of letter signals on the transmitting tape are of varying length. It is consequently not possible to pull back the transmitting tape letter by letter in the keyboard perforator. It has to be adjusted by hand, or pulled back unit by unit, a process necessarily involving some loss of time, and many corrections in this way would materially reduce the output of the operator. In the Buckingham system, also, it is necessary to rub out everything as far as the end of the previous line. Hence, to correct a single letter a whole line may have to be rubbed out. With automatic systems like the Murray, using an alphabet in which the letter signals are all of the same length, the transmitting tape, while being prepared in the keyboard perforator, can be pulled back instantly letter by letter by depressing a lever. If an operator strikes a wrong key, all he has to do to rectify his error is to strike the back-spacing lever, the letter-shift key, and the desired letter—the work of a moment. A word of six letters can be blotted out in this way in a few seconds, and no trace of the correction, not even a blank space, will appear in the printed message at the other end of the line. This relieves the operator from the dread of striking a wrong key, the strain on his attention is less, and he can work faster without working harder. One or two automatic type-setting patents have included schemes for correcting errors in the perforated tape; but, as far as I am aware, the Buckingham was the first printing telegraph to adopt a plan for invisible correction, and the Murray system was the first, and, so far, is the only system having the power to correct instantly single letters or words.

The correction is made by striking the letter-shift key (caps). This punches five holes in a letter space, and so blots out all other permutations which may have been previously punched. At the other end of the line this signal leaves the printer unaffected, its function being to shift the action of the printer from figures to letters. The signal may be repeated half a dozen times, so as to blot out a whole word, and there will be no trace of the error in the printed message.

Another improvement in the system is that by which the transmitting and receiving slips are made identical. In the new transmitter there is only one row of message holes in the tape. The signals depend on the relative positions of perforated and non-perforated units of tape. The tape and the transmitter together form the collector. The usual Wheatstone star-wheel feeds the tape forward by means of the central row of holes in the tape, rack-and-pinion fashion. In place of the two small upright rods, as used in the Wheatstone system for entering the holes in the tape, there is a single rod pivoted at one end of a horizontal thrust lever. This vertical lever is kept oscillating steadily by a small eccentric wheel. The result of the oscillations of this lever is to cause the horizontal thrust lever to operate also. The free end of this thrust lever is placed close to the two free ends of two converging thrust bars, which are pivoted one on each side of the pivot of an ordinary Wheatstone contact lever. These converging thrust levers are lightly pressed against a friction roller by two small steel springs. When the machine is in operation, a tape perforated with a message is being fed through in the ordinary Wheatstone manner, and the single small steel rod mentioned above reciprocates regularly against the paper. It makes one reciprocation for each unit of the tape. If there is a message hole in the tape, the tip of the rod enters the hole, and the complete motion of the rod is unobstructed. This permits the thrust lever to move as if it were one piece with the vertical lever, and the oscillation causes its free end to strike the free end of the lower thrust bar, throwing the contact lever over to one of the marking contacts. If the next oscillation of the small upright rod again enters a hole in the tape, the same action is repeated, but the contact lever being already against a marking contact and held there, no change is made in its position, and marking current continues to be sent out to the line. If a non-perforated unit of tape intervenes, the small rod is obstructed by the tape, and oscillation of the vertical lever causes the rod to depress its end of the other thrust lever. This throws the contact lever over, and thereby breaks the marking current, and throws spacing current into the line.

The method of securing unison is interesting and is thus described:

In the Murray system the question of unison is removed from the line to the tape. As with the Wheatstone recorder tape, it is a question of correctly dividing up the signals on the tape. With the five-unit alphabet each letter occupies five units, or one-half inch on the tape. Hence, to divide up the signals properly we have to start at the right unit and then measure five units at a time. The star-wheel does the measuring, and all that is necessary is to place the tape properly on the star-wheel. To enable this to be done with facility, each batch of messages begins with four or five space signals. The space signal is a perforation in the third-unit position. In the star-wheel every fifth tooth is omitted and the vacant tooth positions blackened. The tape is inserted in

the machine so that the space holes come opposite the missing teeth of the star-wheel, which show up black through every fifth central hole in the tape. The tape is then in unison. In the event of it not being in unison, it can be put in step by rotating a small unison arm. This bags up and advances the tape on the star-wheel to the extent of one unit. A maximum of four and an average of two revolutions of the unison arm brings the tape into step. The unison arm when not in use is held locked. The missing teeth in the star-wheel and the space signals show at a glance at the beginning of a message whether the tape is in step. If a line interruption causes the unison to fail in the middle of a message two or three revolutions of the unison arm by the attendant set all right again.

Telephones and Tallow Candle Methods.

The remark is often made in varied forms of expression until it becomes an unphrased adage, that the lay mind is the suggestive mind.

Those who are immersed in the operative details of any calling are apt to be blinded by their environment so as not to perceive possible short cuts or to initiate the development of new methods. It is not a premium on ignorance for a bystander to make a valuable suggestion, but it is the action of a mind unhampered by conventionalities of that subject.

In this connection, Frank J. Peaslee, superintendent of schools at Lynn, Mass., sententiously expressed in his annual report the functions of the telephone in this year of grace:

I believe that telephones should be provided for all of the larger school buildings. These to be connected with the office of the school department in City Hall, for the transmission of all kinds of information between the school officials and the schools, but not for the use of the general public. They would annihilate time and distance in the administration of school work and be of incalculable service and value to all parties for whom intended. Superintendent Southworth, of Somerville, said in his school report for 1902, "If I wish to communicate with a school in Chelsea, Malden, Everett, Revere, or almost any city about me I can do so from my office, but if I wish to communicate with one of my own schools I must spoil half a day to do so." The telephone is an instrument of modern business. Is there any other enterprise, involving any considerable fraction of the amount of money expended in this department, that is carried on without this modern instrument? No business man having charge of industries in a dozen different buildings, containing from three hundred to eight hundred persons each and located in all parts of the city, would for a moment depend solely upon going from one building to another for communication with those different buildings. Why should the schools of to-day be doing business after the method of the tallow-candle days?

SOME POINTS ON THE SELECTION OF ELECTRIC CABLES.[1]

BY L. B. ATKINSON AND C. J. BEAVER.

(*Concluded.*)

APPENDIX I.

GLOVER'S TEST FOR TINNED HIGH CONDUCTIVITY COPPER WIRE.

Samples—From the batch of wire to be tested true average samples are taken, the number of samples being proportioned to the total weight of the batch and to the gauge of the wire, for works purposes. Two classes of samples are taken:

(a) Samples from interior parts of coils or bundles, the results obtained from which may be taken to indicate the actual efficiency of the tinning.

(b) Samples from exterior parts of coils or bundles, to show to what general extent the efficiency of the tinning has been impaired by mechanical abrasion in transit or handling.

For consulting engineers or inspectors' purposes samples are taken from the strand before the cable is vulcanized.

Reagents—Hydrochloric acid of S. G. 1.088 (= forty-four per cent of acid of 1.2 S. G.)

Sodium sulphide solution of S. G. 1.142 (= about twenty-five grammes per 100 cubic centimetres of water.)

Testing Process—The samples are cleaned with alcohol or ether, and immersed for one minute in the hydrochloric acid. They are then rinsed in clear water, and immersed in the sodium sulphide solution for thirty seconds, again washed, and examined under a hand lens.

This cycle of operations is repeated until blackening of the wire becomes clearly visible. The number of such cycles required to produce this blackening effect is noted, and taken to represent the measure of efficiency of the tinning.

The tests are performed in duplicate.

The wires are bent into loops before immersion to avoid testing ends. The loops should not be bent to a smaller radius than twelve to fifteen times the diameter of the wire.

As a mechanical test for adhesion of the tinning to the wire, samples may be bent around a rod having a diameter equal to four times the diameter of the wire. Any cracking or parting of the coating will be plainly shown by one immersion, according to the test described above.

No wire should show blackening after the mechanical test on immersion for one minute in the sodium sulphide solution only.

The average values obtained from samples taken from any batch of wire should be as shown below:

Diameters of Wires. Inches.	Number of Immersions at 60° F.	
	Single-Tinned Wire.	Double-Tinned Wire.
From 0.0076 to 0.048 inclusive...	6	8
Above 0.048 to 0.080 "	5	7
" 0.08) all sizes.....	4	5½

NOTE—In practice a variation of one immersion from the average values tabulated above may be allowed if the batch of wire under test gives fairly uniform results. If a wide variation between individual tests is observed, further samples may be taken, as it would obviously be unfair to allow an isolated defective sample to bring down the average value obtained on the samples. A little experience enables the operator to readily distinguish between defects due to imperfections in the tinning process and those due to subsequent mechanical damage.

APPENDIX II.

GENERAL SPECIFICATION FOR LIGHTING AND POWER CABLES FOR LOW-TENSION PRESSURES UP TO 500 VOLTS.

Lead-Covered Paper Insulated Cables—Conductors of plain copper, as per paragraph 1, insulated with Diatrine paper, as per paragraph 3, lead-covered, as per paragraph 5.

Vulcanized Rubber-Insulated Cables—Conductors as per paragraph 2, pure and vulcanized insulation, as per paragraph 4, taped and braided, as per paragraphs 7 and 8.

Leadless Paper Cables—Conductors as per paragraph 1, insulated with paper, as per paragraph 3, and sheathed with bitumen compound, as per paragraph 6, taped and braided or lapped, as per paragraphs 7 and 8.

Bitumen Cables—Conductors as per paragraphs 1 and 2, the outer layer of the strand being composed of tinned copper wires, insulated with bitumen compound, as per paragraph 6, finished with tapes and braids or lappings, as in the case of the leadless paper cables, as per paragraphs 7 and 8.

Fire-Resisting Cables—Conductors as per paragraph 2, pure and vulcanized rubber, as per paragraph 4, taped and braided as per paragraphs 7 and 9.

MATERIALS.

1. Conductors—Conductors of all wires and cables are to be of solid, well-annealed, high-conductivity copper, English drawn, the strands of cable to be of suitable lay, so as to produce a compact conductor. The conductivity of the copper to be not less than 100 per cent of pure copper, Matthiessen's standard. The resistances and weights of the various sizes to be as specified in the Cable Makers' Association circular, dated December 31, 1902.

2. Where cables are insulated with materials which will react with, or be acted upon by the copper, the wires are

[1] Abstract of paper read before the Institution of Electrical Engineers, of Great Britain, January 31, 1905.

to be uniformly and efficiently tinned. The tinning is to be free from lead or other impurities, and must conform to Glover's standard test for tinned high-conductivity copper wires. No joints in single wires are to be within twelve inches of one another.

3. Dielectric Paper—The paper to be composed of pure manila fibre. It is to be free from all metallic particles, carbon spots or foreign matter, and to show no trace of chlorine or other residual chemicals on analysis. It must be free from the slightest admixture of straw, wood or other ligneous fibres. The paper after drying to be impregnated with a high-class insulating compound at a temperature not exceeding 250 degrees Fahrenheit, and to be laid spirally upon the conductor in strips to required thickness in such a manner that the joints are efficiently staggered. The paper strip to be of uniform thickness throughout, not exceeding 0.006 inch before impregnation. The tensile strength of a standard strip fifteen millimetres wide, cut longitudinally from the paper before impregnation must not be less than ten kilogrammes, but it should be so highly impregnated that its strength is increased by fifteen per cent after impregnation. The insulating compound should be of such a character that it is solid at the ordinary working temperature, and should have no tendency to drain away from the cable. It should also be capable of allowing the cable to be sharply bent without any sign of cracking in the paper dielectric. The compound must have no deleterious effect on the copper, paper or lead.

4. Rubber—The conductors are to be covered, first, with a layer of pure unvulcanized fine Para rubber, containing not more than 2.25 per cent of rubber resin, and then with two layers of vulcanizing rubber compound to an approved thickness. The vulcanizing rubber compounds to consist of the finest hard Para rubber mixed with sulphur and mineral matter only. No rubber substitute or organic matter other than rubber is to be used. The proportion of hard fine Para rubber in the vulcanizing compound rubber, in the case of the 500-volt cables, is to be not less than forty per cent by weight. In the case of wire, or cables having a sectional area of less than 0.06 square inch, the rubber compound is to be applied longitudinally. Larger cables are to be spirally lapped to an approved thickness. The pure and compound rubbers to be vulcanized into a homogeneous mass after taping.

5. Lead Sheathing—The cable to be sheathed by a solid tube of the best pure English lead which shall not contain more than 0.5 per cent total impurities on analysis, and shall be free from pinholes, lead oxide and other manufacturing defects, and shall be made direct on the insulated core under strong hydraulic pressure, the lead being allowed to set before pressure is applied. The insulated core to be passed through a bath of compound immediately prior to its entering the lead press. The lead sheathing shall be of uniform thickness, and shall not show any signs of cracking after having been subjected to the bending tests hereafter specified.

6. Compound—To be of the vulcanized bitumen class of compound, containing not more than twenty per cent of mineral matter, to be of such consistency that it will not become decentralized at such temperatures as ordinarily obtained in practice. It must not become brittle at the freezing point of water. It must be so made that it is not really oxidizable, and that it will resist the action of weak acids and alkali. It is to be applied to the cable in the form of a solid tube free from pinholes and similar defects, so that the insulation resistance shall show no deterioration after the insulated cable is submitted to hydraulic pressure of 100 pounds per square inch for at least five minutes.

7. Tapes—Tapes for vulcanized rubber cables should be of fine cotton cloth, counting not less than seventy by seventy per square inch, thoroughly waterproofed on one side with rubber compound containing not less than thirty-five per cent of pure rubber. Tapes for leadless and bitumen type of cables to be of stout cotton cloth thoroughly impregnated with bituminous compound. For outer coverings Hessian tapes treated in a similar way before application to the cable may be used when required.

8. Braidings and Lappings—For rubber cables the braiding may be of jute or cotton, tanned or gray, as required; to be braided on the cable at a suitable lay, and with a sufficient number of ends to efficiently cover the cable. The braidings for main cables, whether rubber, leadless paper, or bitumen cables, should be of tanned jute. In all cases braids are to be efficiently impregnated with preservative compound. In the case of main cables, jute lappings may be used instead, or in conjunction with braidings, as above described; such lappings should be of tarred jute, containing not less than forty-five per cent of the best Stockholm tar. After application to the cable these lappings should be thoroughly impregnated with preservative compound.

9. Fire-Resisting Coverings—The fire-resisting coverings may consist of cotton tapes, jute, or cotton lappings, or braidings. The radial thickness of such coverings to be proportionate to the diameter of the cable and the radial thickness of the insulation. The tapes, braids, or lappings to be chemically treated prior to their application to the cable, with suitable fire-resisting compound, which shall have no deleterious effect on the fibrous material or the insulation of the cable, and shall be of a permanent character. During the taping, lapping, or braiding process the fire-resisting coverings to be further served with suitable fire-resisting compound, and finally served over all with special compound of a similar nature, to ensure a firm but flexible finish.

In special cases leadless or bitumen cables may be finished with fire-resisting coverings, as above described.

10. Armor—Where cables are to be laid direct in the ground or in situations where they may be exposed to mechanical injury, they should be armored with steel tapes of suitable widths and of thicknesses as specified in the Cable Makers' Association circular, dated December 31, 1902, and applied to the cable, so that the spaces between the convolutions of the first layer of steel tape are covered by the second tape. Joints in steel tapes are to be either brazed or welded, no other method being allowable. They are to be laid on a bed of tarred jute, served as described above, and covered with a double layer of jute in a similar manner. Where galvanized iron or steel wires are used as armor, the wires must closely sheath the cable and be applied over a bed of tarred jute lapped on in the opposite direction to the lay of the wires. The wire should be of suitable gauge, and composed of a good quality of steel, which should have a breaking strain of not less than twenty-five tons per square inch, and should be capable of being bent round its own diameter in reverse directions without fracture. The galvanizing must adhere firmly to the surface of the wire, and must not crack or scale off when the wire is bent round a cylinder twelve times its own diameter. The efficiency of the galvanizing must be such that no sign of a deposit of copper should be visible after three one-minute immersions in a saturated solution of copper sulphate at sixty degrees Fahrenheit.

11. Insulation Tests—All cables, as specified above, should be tested after twenty-four hours' immersion in water in the case of vulcanized rubber cables, and after five minutes' hydraulic test in a closed tank at 100 pounds per square inch in the case of the other types with a battery giving an electromotive force of not less than 500 volts. The insulation resistance must be taken after one minute's electrification, and such electrification must proceed steadily and uniformly. After the application of 2,500 volts for half an hour there should be no appreciable difference in the insulation resistance of the cables.

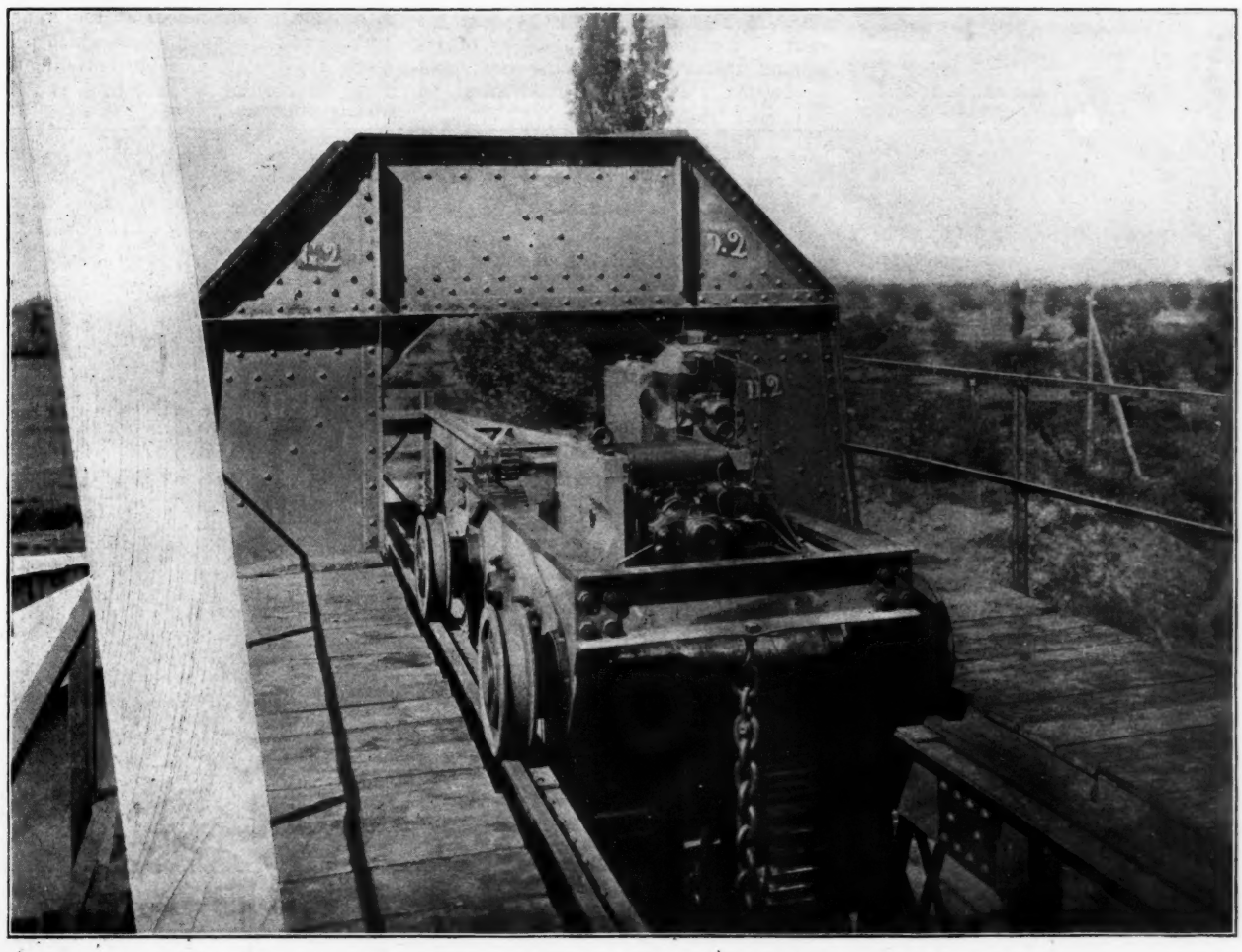
12. Mechanical Tests—A ten-foot length may be taken from any of the cables and bent three times in reverse directions round a drum having a diameter of not more than twelve times the diameter of the cable. The length when subsequently immersed in water, and tested with a gradually increasing voltage, should not break down under a pressure of 5,000 volts.

Electric Crane at the St. Triphon Quarries, Switzerland.

By C. L. Durand.

THE quarries of St. Triphon are situated in the valley of the Rhone at about one-half mile from the railroad station of St. Triphon, near Lake Leman, Switzerland. It has not been very long ago since the operations of taking the marble from the quarries, forming it into blocks of given dimensions, and transporting it to the nearest railroad station were carried out in a very primitive fashion, giving rise to manœuvres which were long and dangerous and presenting great difficulties. In this way the yield which was obtained from the quarries within a given time was relatively small compared with what is produced at present, owing to the use of improved machines which are employed in all parts of the quarries. The different operations are now carried out with great ease and at a high rate of speed.

The method of cutting the blocks deserves mention, in the first place. The blocks are sawed by means of a cutting cable which is formed of three hard steel wires of 2 or 2.5 millimetres diameter, twisted together to form a strand. This cable is given a movement at the rate of two metres per second at the maximum. The cable is endless, and runs upon a set of jointed pulleys which allow it to take any desired direction and to descend progressively as the cutting advances. A stream of fine silicious sand and water is brought upon the wire to allow it to cut the marble to the best advantage.



THE CAR OF THE ELECTRIC CRANE AT THE MARBLE QUARRIES, ST. TRIPHON, SWITZERLAND.

The most noteworthy feature of the St. Triphon quarries is the new electric lifting and conveying apparatus, which is the only one in Switzerland at the present time. Some analogous apparatus are now in the largest marble quarries of Belgium. The engraving gives an idea of the apparatus. It travels upon a short track which is laid on either side. The distance between the tracks is thirty metres and each track is formed of two rails placed near together and solidly fixed upon cross-ties. The crane is supported upon rollers of cast steel, of which there are two per pillar, and these allow the great crane to move along without an undue amount of friction. Each of the two pillars is built of iron construction which spreads out at the bottom and becomes narrower at the top. It thus gives passage to the traveling carriage and the load. The whole construction is formed of a light ironwork which is very solid and capable of carrying a heavy load. The crane will lift and carry loads reaching as high as forty tons. The total length of the main bridge of the crane is 47.4 metres. The rails carrying the car are 10.8 metres above ground, while the pillars rise 2.5 metres above this level. There is a distance of 8.2 metres between the ground and the main bridge which allows for the largest loads. The maximum load reaches thirty to forty tons. The heaviest pressure upon the track is obtained when the load arrives at the outer end of the

overhanging part (9.8 metres from the pillar) and here the two rollers of the pillar have to transmit an effort of eighty-eight tons upon the rail, seeing that the weight of the load is to be added to the weight of the crane, which represents ninety tons.

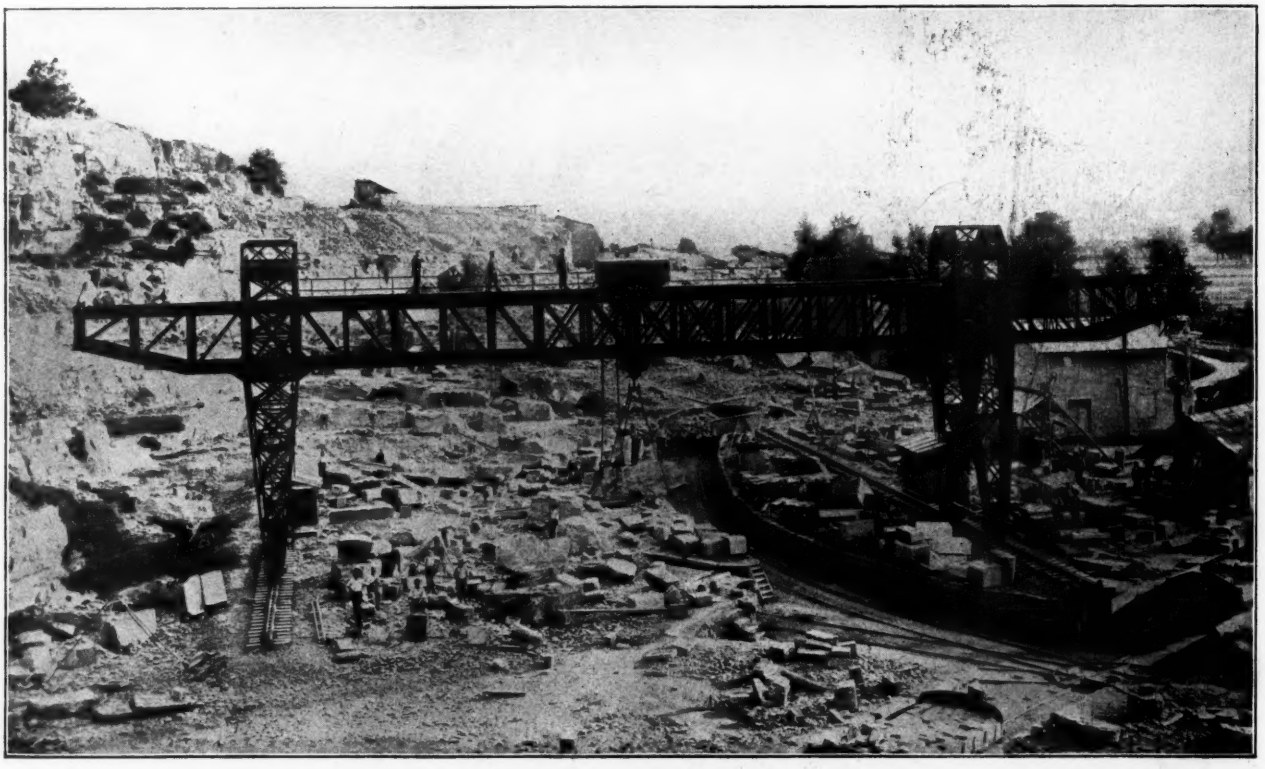
The traveling carriage is shown in one of the engravings. It is operated by electric motors, for the lifting and the side movement of the carriage. The whole operation of the crane is obtained by four motors which are placed upon a 110-volt direct-current circuit, and are distributed as follows: the movement of the crane upon the track is carried out by two motors of the Thury M5 type, series-wound, giving about 7.5 horse-power each. The motors are placed one in each of the supporting columns of the crane and are connected across by a rigid transmission. The motors work at a speed of 1,300 revolutions per minute, and this is reduced to thirty-eight revolutions by means of an endless screw which works in oil. The two motors are alike both as to power and speed and are supposed to work together, but it was considered advisable to join the shafts by a strong transmission running across the crane, so that one of the motors could not work without the other and make one of the pillars advance.

The carriage is made to run upon the main bridge by a series-wound motor of the Thury type, giving five horse-power. It gives the movement to the carriage by means of an endless screw working in oil and a gearing transmission. The motor works at a speed of 1,350 revolutions per minute, which is reduced to twenty-two revolutions by the screw and a wheel of sixty teeth. The load is lifted by a compound-wound motor of fourteen horse-power which is mounted on the car as will be observed in the foreground. This motor operates at 900 revolutions per minute, which is reduced to 15.5 revolutions by an endless screw. The control of the three movements of the crane is carried out from a cabin which is placed in one of the supports at the side. A rheostat controller is used for each of the motors which allows of reversing them and regulating the speed as desired. The lifting mechanism on the carriage is provided with a powerful brake which is easy to regulate.

In spite of the great weight of the mass, the crane, when it is once started, can work with a relatively small current, twenty-two to twenty-five amperes at 110 volts, which figures from 3 to 3.5 horse-power. With a total consumption of fifteen to twenty horse-power, the speeds of the different manœuvres gave the following figures during the first period of operation: lifting of the load, 0.75 metre per minute; running of the car upon the bridge, 6.70 metres; speed of the crane on its track, 8.55 metres per minute. It will be seen by these figures that the speed of carrying out the manœuvre was already very high, but more recently these figures have been nearly doubled for the last two movements. As to the lifting of the load, in case where only small blocks are to be raised, this movement can now be carried out with a speed four times as high as before, owing to a different arrangement of the chain.

The current which is required for the motors is furnished by a thirty-horse-power 110-volt generator. The latter is driven from a motor of the same capacity, placed on the circuit which comes from the hydraulic transmission plant of Grande Eau. This plant uses the Thury system of constant-current series, working at fifty amperes, carried out by the Compagnie l'Industrie Électrique. Current is brought to the motors on the crane by trolleys running upon a line which passes along the track. For the traveling carriage the current is taken from two lines placed along the bridge by a set of rubbing contacts.

In order to transport the blocks from the quarry to the railroad station of St. Triphon in the most practical manner, a small electric line has been installed. It uses a locomotive which carries two Thury motors of fifteen horse-power each, working at 110 volts. The locomotive can draw two or three loaded cars, and thus gives a very efficient method of hauling. Current is brought to the locomotive by a trolley, with rail return, but in the quarry itself a line is run a few inches from the ground, so as not to interfere with the operations, and the current is taken by contact arms on the locomotive.

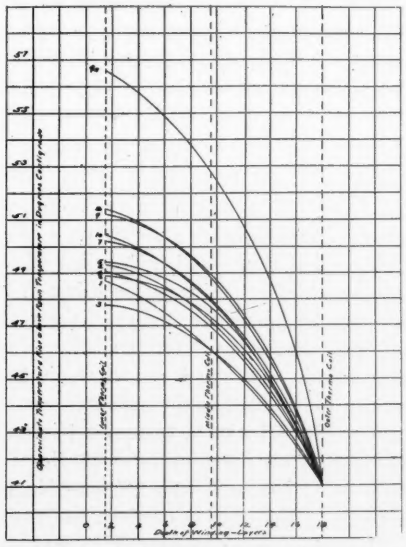


THE ELECTRIC CRANE AT THE MARBLE QUARRIES, ST. TRIPHON, SWITZERLAND.

TESTS TO DETERMINE THE COMPARATIVE HEAT CONDUCTION AND RADIATION OF INSULATING VARNISHES.

BY JOHN C. DOLPH.

The necessity of providing liquid insulation for cotton covering of copper wire in coils has long been recognized. Whether the use of varnishes or compounds is really necessary, other than as a means of protection against moisture, especially in low-voltage work, has been open for discussion. The knowledge that some sort of liquid insulation is required has been gained from actual experience in shop practice where it has been found that coils impregnated with a varnish or compound outlasted coils which had been wound up dry, and only the outside layers of which were protected against moisture. This

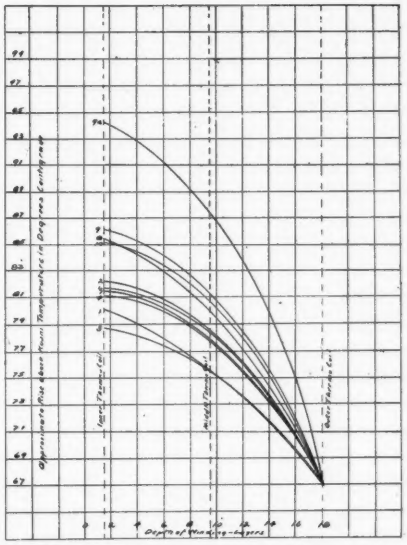


TEST NO. 1.—TO DETERMINE THE COMPARATIVE HEAT CONDUCTION AND RADIATION OF INSULATING VARNISHES.

was found to be especially true of coils containing a great depth of wire.

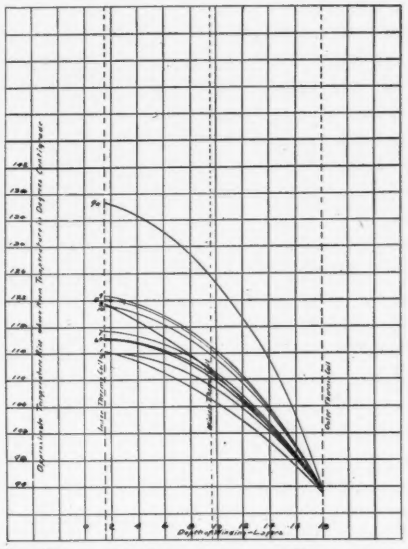
Early in 1903 the writer was impressed with the idea that the life of the coils could be greatly lengthened by increasing the natural tendency of insulating varnishes to dissipate heat either by radiation or conduction, or both. All experience up to this time had clearly demonstrated that ordinary insulating varnish was a very poor conductor of heat, and it was taken for granted that any improvement in this direction would carry with it the introduction into the varnish of material which would have a tendency to lower to the danger point the dielectric strength of the varnish coating.

With these conditions in mind the writer began a series of experiments with varnishes and compounds with the idea of treating them in such a manner as to produce a compound which would constitute an improvement over anything then in use in its ability to conduct and dissipate by radiation the heat generated in the insulation of the windings of high-potential alternating-current apparatus.



TEST NO. 2.—TO DETERMINE THE COMPARATIVE HEAT CONDUCTION AND RADIATION OF INSULATING VARNISHES.

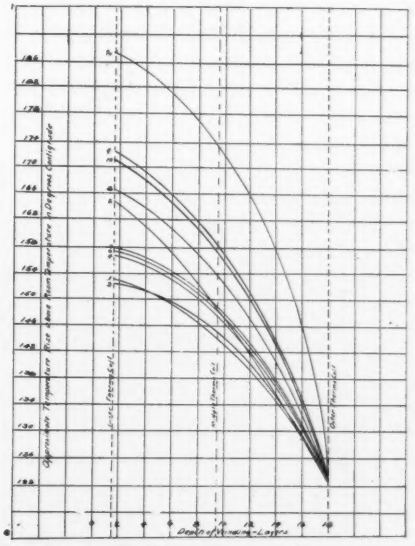
These experiments led to electrical tests to determine whether or not any advantage had been gained by the treatment mentioned. This preliminary test was carried out by taking standard arc lamp spools and running the wire with which they



TEST NO. 3.—TO DETERMINE THE COMPARATIVE HEAT CONDUCTION AND RADIATION OF INSULATING VARNISHES.

were wound through the varnish to be tested. Current was then put through the spools until a temperature of approximately 160 degrees centigrade had been reached, which was determined by thermometers placed inside and outside of the spools, so that readings could always be seen of the temperatures inside and outside the coils, and comparisons made at a glance.

While the above test was not satisfactory, owing to the uncertainty of temperature readings, it demonstrated clearly that there existed a great difference between the temperature of coils insulated with the varnish specially treated for heat radiation and conduction and the ordinary insulating varnish. The next step was to determine accurately this difference, and with that end in view the writer took up the matter with Dr. Sharp of the Electrical Testing Laboratories. After consultation it was decided that the following would be a good method to determine the combined heat radiation and conduction of various varnishes.



TEST NO. 4.—TO DETERMINE THE COMPARATIVE HEAT CONDUCTION AND RADIATION OF INSULATING VARNISHES.

A number of tin cans were provided, on the outside of each of which a layer of cloth was tightly fastened, the cloth then being painted with three coats of the varnish to be tested. Dry steam having ten degrees centigrade of superheat was then passed through each can in turn and by a series of experiments the amount of steam condensed per minute was determined. At the same time a thermopile set up at a given distance from the can was used to determine the relative radiating powers of the surfaces which were afterward expressed in the terms of galvanometer deflections. An uncovered tin can, as well as a can covered with soot, was provided for the purpose of comparison. These tests established beyond any question the marked superiority in point of combined heat radiation and conduction of the specially treated varnishes over the

ordinary insulating varnishes. During these tests a peculiar condition developed as regards one of the clear oleoresinous base varnishes under test. While this varnish was naturally a poor radiator of heat, owing to the nature of its surface, it proved to have got rid of a larger proportion of heat than any of the other varnishes tested with the exception of that conduction. Inasmuch as this oleoresinous base varnish possessed good insulating properties, it occurred to the writer that varnishes of this description, in view of this important characteristic, were the ones which would eventually give the best results, provided they could be so treated as to develop the necessary heat radiation and conduction without the sacrifice of their high insulating properties.

RESULT OF TEST NO. 1.

Spool Number.	Thermo. Coil.	Resistance in Ohms. Initial.	Final.	Increase.	Increase of Temperature Degrees C.	Difference in Temperature, I. = O. Coil. Degrees.
1	Inner	107.10	129.50	22.40	52.3	
	Middle	116.60	139.80	23.20	49.7	
	Outer	98.30	115.85	17.55	44.6	7.7
2	Inner	109.05	132.35	23.30	53.4	
	Middle	117.25	141.40	24.15	51.3	
	Outer	101.70	120.00	18.30	45.1	8.3
3	Inner	112.75	135.70	22.95	51.0	
	Middle	119.85	143.50	23.65	49.3	
	Outer	75.50	206.60	31.10	44.2	6.8
4	Inner	112.65	136.10	23.45	52.2	
	Middle	120.70	144.90	24.20	50.2	
	Outer	174.95	205.90	30.95	44.2	8.0
5	Inner	109.10	130.60	21.50	49.4	
	Middle	118.50	141.10	22.60	47.7	
	Outer	16.07	18.71	2.64	41.0	8.4
6	Inner	108.30	131.50	23.20	53.5	
	Middle	116.45	140.60	24.15	51.9	
	Outer	101.55	120.10	18.55	45.6	7.9
7	Inner	109.20	132.70	23.50	53.8	
	Middle	118.60	143.10	24.50	51.6	
	Outer	*102.40	120.70	18.30	44.6	9.2
8	Inner	106.95	131.10	24.15	56.4	
	Middle	117.00	142.20	25.20	56.5	
	Outer	105.15	124.60	19.45	46.2	10.3
9	Inner	109.75	134.00	24.25	55.2	
	Middle	115.95	140.50	24.55	52.9	
	Outer	102.00	120.40	18.40	45.0	10.2
9a	Inner	110.50	138.70	28.20	63.8	
	Middle	119.80	148.60	28.80	60.0	
	Outer	99.50	118.70	19.20	48.2	15.6
10	Inner	108.00	131.60	23.60	54.6	
	Middle	119.30	144.20	24.90	52.1	
	Outer	104.10	122.90	18.80	45.2	9.4

*This thermometric coil was found during the test to have one of the wires partially broken, consequently the initial resistance is somewhat uncertain. The outer thermometric coil on the impregnated coil, No. 5, was found to be open-circuited. Some other wire was wound on, but not of sufficient size to give the same resistance as the original. It was put on, however, with the idea that it would be better than nothing. The insulating compound in the impregnated spool, No. 5, began to run pretty badly at these temperatures. (At ordinary temperature the material is rather sticky to the touch, but does not begin to flow until it reaches a temperature of forty degrees to fifty degrees centigrade.)

RESULT OF TEST NO. 2.

Spool Number.	Thermo. Coil.	Resistance in Ohms. Initial.	Final.	Increase.	Increase of Temperature Degrees C.	Difference in Temperature, I. = O. Coil. Degrees.
1	Inner	107.65	142.70	35.05	81.5	
	Middle	117.15	153.30	36.15	77.1	
	Outer	98.75	125.80	27.05	68.5	13.0
2	Inner	108.75	145.10	36.35	83.6	
	Middle	117.80	155.50	37.70	80.0	
	Outer	102.20	130.20	28.00	68.4	15.2
3	Inner	113.35	149.30	35.95	79.3	
	Middle	120.50	157.15	36.65	76.0	
	Outer	176.40	224.05	47.65	67.6	11.7
4	Inner	113.20	150.20	37.00	81.7	
	Middle	121.30	159.30	38.00	78.3	
	Outer	175.80	223.30	47.50	67.6	14.1
6	Inner	108.90	145.40	36.50	83.8	
	Middle	117.10	154.80	37.70	80.5	
	Outer	102.10	130.30	28.20	69.1	14.7
7	Inner	109.85	146.30	36.45	83.1	
	Middle	119.25	157.20	37.95	79.5	
	Outer	102.90	131.10	28.20	68.6	14.5
8	Inner	107.60	146.30	38.70	89.9	
	Middle	117.70	157.90	40.20	85.4	
	Outer	105.70	135.90	30.20	71.5	18.4
9	Inner	110.40	149.60	39.20	88.8	
	Middle	116.70	155.90	39.20	84.0	
	Outer	102.70	131.30	28.60	69.7	19.1
9a	Inner	111.20	156.70	45.50	102.2	
	Middle	120.50	166.50	46.00	95.5	
	Outer	100.10	130.10	30.00	75.0	27.3
10	Inner	108.70	146.80	38.10	87.7	
	Middle	120.00	159.90	39.90	83.2	
	Outer	104.70	133.80	29.10	69.5	18.2

It was then determined to ascertain by electrical means, the relative combined heat conducting and radiating properties of various oleoresinous and hydrocarbon base varnishes. There were provided eleven spools, approximately six inches in length and three inches in diameter. These spools were wound with No. 18 double cotton-covered wire, eighteen layers and 108 turns to the layer, making a total of 1,944 turns. In these coils were wound thermometric coils, the outside of No. 38 silk-covered wire with two turns per space, making a total of 214 turns, a middle thermometric coil of No. 40 silk-covered wire, two turns per space, with a total of 214 turns, and an inner thermometric coil of No. 40 silk-covered wire, three turns per space, making a total of 321 turns. These coils were wound on a split form so that they could be handled without the addition of insulation other than that provided by the covering of the wire and the varnish used on the coil. The wire in all cases was run through the varnish to be tested as the wire was wound on the coil. The inner thermometric coil was wound on the first layer of No. 18 wire, as of course it was not possible to wind it on the outside of the first layer.

The spools were numbered from 1 to 10, inclusive, and were treated with varnishes and compounds as follows:

No. 1 Spool—Clear, quick baking, dipping varnish of an oil and gum-base variety.

No. 2 Spool—Clear, baking, dipping varnish of an oil and gum-base variety.

No. 3 Spool—Heat-radiating varnish, brown, dipping baking, of a combined oleoresinous variety, specially treated for heat radiation and conduction.

No. 4 Spool—Black, dipping varnish of an oil and hydrocarbon base variety.

No. 5 Spool—Black, solid compound of bituminous variety, liquefied under heat and used only in connection with vacuum impregnation apparatus.

No. 6 Spool—Black, brushing varnish of a combined oil and hydrocarbon base, treated for heat radiation and conduction.

No. 7 Spool—Clear, baking, dipping varnish of an oleoresinous variety.

No. 8 Spool—Black, air-drying and

RESULT OF TEST NO. 3.

Spool Number.	Thermo. Coil.	Resistance in Ohms. Initial.	Final.	Increase.	Increase of Temperature Degrees C.	Difference in Temperature, I. = O. Coil. Degrees.
1	Inner	108.70	158.80	50.10	115.3	
	Middle	118.40	169.80	51.40	108.4	
	Outer	99.75	137.30	37.55	94.2	21.1
2	Inner	109.85	164.20	54.35	123.6	
	Middle	119.00	173.00	54.00	113.4	
	Outer	103.30	142.70	39.40	95.3	28.3
3	Inner	114.50	166.90	52.40	114.5	
	Middle	121.70	175.00	53.30	109.7	
	Outer	178.20	245.00	66.80	93.6	20.9
4	Inner	114.35	167.80	53.45	116.8	
	Middle	122.50	176.90	54.40	111.0	
	Outer	177.50	244.00	66.50	93.7	23.1
6	Inner	110.00	163.10	53.10	120.7	
	Middle	118.20	172.70	54.50	115.2	
	Outer	103.00	143.20	40.20	97.6	23.1
7	Inner	110.90	164.00	53.10	119.8	
	Middle	120.40	175.20	54.80	113.8	
	Outer	104.10	143.90	39.80	95.5	24.3
8	Inner	108.60	165.70	57.10	131.3	
	Middle	118.80	177.70	58.90	123.8	
	Outer	106.60	150.20	43.60	102.2	29.1
9	Inner	111.30	168.60	57.30	128.7	
	Middle	117.70	174.70	57.00	121.2	
	Outer	103.50	144.50	41.00	99.1	29.6
9a	Inner	112.00	179.30	67.30	150.0	
	Middle	121.60	189.20	67.60	139.0	
	Outer	100.90	143.80	42.90	106.4	43.6
10	Inner	109.60	165.50	55.90	127.6	
	Middle	121.05	179.40	58.35	120.4	
	Outer	105.60	147.70	42.10	99.6	28.0

RESULT OF TEST NO. 4.

Spool Number.	Thermo Coil.	Resistance in Ohms. Initial.	Final.	Increase.	Increase of Temperature Degrees C.	Difference in Temperature, I. = O. Coil. Degrees.
1	Inner	108.50	175.40	66.90	154.0	
	Middle	118.00	186.40	68.40	145.0	
	Outer	99.50	148.50	49.00	123.2	30.8
2	Inner	111.40	186.10	74.70	167.5	
	Middle	118.80	190.40	71.60	150.8	
	Outer	103.00	154.40	51.40	124.9	42.6
3	Inner	114.30	184.30	70.00	152.9	
	Middle	121.50	192.20	70.70	145.4	
	Outer	177.90	265.20	87.30	122.7	30.2
4	Inner	114.10	185.80	71.70	157.1	
	Middle	122.30	194.70	72.40	147.9	
	Outer	177.30	264.30	87.00	122.6	34.5
6	Inner	109.80	180.60	70.80	161.2	
	Middle	118.10	190.00	71.90	152.2	
	Outer	103.00	154.90	51.90	126.1	35.1
7	Inner	110.70	180.80	70.10	158.3	
	Middle	120.20	192.00	71.80	149.2	
	Outer	104.70	156.00	51.30	122.7	35.6
8	Inner	108.55	186.60	78.05	179.7	
	Middle	118.80	198.10	79.30	166.8	
	Outer	106.60	164.30	57.70	135.3	44.4
9	Inner	111.40	194.00	82.60	185.2	
	Middle	118.30	199.20	80.90	170.9	
	Outer	103.55	159.50	55.95	135.0	50.2
9a	Inner	111.90	.....	....	....	
	Middle	121.60	.....	....	....	
	Outer	100.90	.....	....	....	....
10	Inner	109.70	190.10	80.40	183.5	
	Middle	121.10	203.20	82.10	169.5	
	Outer	105.65	162.50	56.85	134.6	48.9

During this test spool 9a began to char badly and the readings became erratic, showing that the thermometric coils were becoming disintegrated. This coil, however, was the only one to show any serious effect. Spool No. 5 was omitted in the last three tests on account of the melting of the insulating compound with which it was impregnated. Spool No. 9a having given out, relative order shown in the following summary was obtained by taking the proportional relations based on spool No. 6, which gave very consistent results throughout.

SUMMARY OF TESTS NOS. 1, 2, 3 AND 4.

Spool Number.	Test No. 1. Ratio.	Relative Order.	Test No. 2. Ratio.	Relative Order.	Test No 3. Ratio.	Relative Order.	Test No. 4. Ratio.	Relative Order.
1	0.494	2	0.466	2	0.844	2	0.465	2
2	0.532	5	0.545	6	0.651	7	0.643	6
3	0.437	1	0.419	1	0.479	1	0.456	1
4	0.510	3	0.506	3	0.530	3	0.522	3
6	0.513	4	0.527	5	0.530	4	0.530	4
7	0.590	6	0.520	4	0.568	5	0.538	5
8	0.661	9	0.581	7	0.670	8	0.663	7
9	0.654	8	0.685	9	0.688	9	0.759	9
9a	1.000	10	1.000	10	1.000	10	1.000	10
10	0.603	7	0.653	8	0.643	6	0.739	8

baking, dipping varnish of one of the hydrocarbon group.

No. 9 Spool—Black, air-drying and baking dipping varnish of a second of the hydro-carbon group.

No. 9a Spool—Untreated coil of No. 18 double cotton-covered copper wire, wound up dry.

No. 10 Spool—Grey, brushing, baking varnish of an oleoresinous variety, treated for heat radiation and conduction.

The varnishes on spools Nos. 1, 2, 3, 4 and 6 were manufactured by the Standard Varnish Works. The varnish used on other spools were those supplied in the market in the United States and Europe for insulating purposes.

It was proposed to obtain the information desired by two similar methods.

1. Heating the spools by passing a constant current through them and getting the temperature at the inner, the outer and middle surfaces by means of the fine wire thermometric coils. (The spool showing the greatest difference between extremes would be the one from which the heat escaped most slowly.)

2. Heating the coils by passing a known constant current through them, and measuring the average rise in temperature of the spool by its increase in resistance. Under the circumstances the spool that became the hottest would be the poorest dissipator of heat.

A number of tests were made, but in the first series the current used was not sufficient to cause a temperature rise in the spools above sixty degrees centigrade. In the last series of tests made, as shown by the curves, sufficient current was used to carry the temperature up to, and in some cases above, that which is met with in the commercial operation of dynamos and motors in service.

The temperature rises were computed from a temperature coefficient of copper assumed to be 0.00383. This is based on the latest value at 0 degrees centigrade, approved by the American Institute of Electrical Engineers (*viz.*, 0.0042), and corresponds to twenty-three degrees centigrade, the general average room temperature throughout the above tests. However, the exact value of the coefficient is unimportant as only comparative results could be expected.

In the last test referred to the spools were all connected in series and set on end on a table in a circle, with about twelve inches of air space between spools. The air spaces in the middle of the coils were corked up at the tops, forcing nearly all of the heat to escape from the outer sur-

faces. The two ends of each thermometric coil were then so arranged that they could be readily connected to a Wheatstone bridge. Arrangements were provided for getting the potential across each spool rapidly at stated intervals. The observations were made as follows: first—the resistance of each thermometric coil was measured on a Wheatstone bridge; second—a known current was sent through the main coils and the fall of potential through each was noted every fifteen minutes for about three and one-half hours or until the drop became constant; third—when the temperature became constant, as indicated by the constancy of the drop, the resistance of the thermometric coils was again measured. (Precautions were taken to have the external radiation conditions the same for all spools and to avoid air draughts.)

The accompanying tabulations give the data and derived results, and the curves herewith show the temperature rise throughout the eleven treated coils and the comparative rise in the untreated coil, No. 9a.

On the diagrams it will be observed that the curves have been shifted up or down, as required, to bring the temperatures at the outside to the same point for all spools. This procedure spreads the curves out more and renders the difference between them more noticeable to the eye.

It should be borne in mind that the above results are affected by both the heat radiating and heat conducting properties of the compounds, hence the relative order obtained can not be said to be due to either alone, but to the combined effects of both.

The spool No. 3 while showing among the best, is treated with a clear dipping baking varnish which has high power of penetration, and whose insulating properties have not been affected by its special treatment for heat radiation and conduction, as will be observed by the table below, which gives the puncture test of the varnishes used on the spools in the test for heat radiation and conduction:

Spool Number.	
1	798 volts per mil.
2	783 " "
3	826 " "
4	703 " "
5	No test made.
6	917 volts per mil.
7	811 " "
8	765 " "
9	890 " "
10	83 " "

The results of the tests for heat radiation and conduction show conclusively the superiority in this respect of coils treated with insulating varnishes or compounds over the untreated coil wound up dry.

With the exception of the first test, the tests above set forth were made under the writer's direction by the Electrical Testing Laboratories, and the data presented herein are taken from their reports. He wishes to express his thanks for the aid and advice given by Dr. Sharp, Mr. Howell and Mr. Farmer of this company, in arranging and carrying out these tests.

National Electrical Conference on Standard Electrical Rules.

The national conference on standard electrical rules composed of delegates representing all interests devoted to the subject whether from the standpoint of manufacturers or operators of electric plants and also including those from the technical associations of the underwriters will hold a meeting at Boston, Mass., on Friday, April 21.

The sessions will be held at 55 Kilby street, room 36.

It is stated that the principal object of the meeting is to consider the matter of the relations of the conference to the National Electric Code, which is the result of the meeting of this conference held at New York on March 18 and 19, 1896, and which has been amended and enlarged at meetings of the Underwriters' National Electric Association until it has about doubled in size.

It is understood that these matters will be thoroughly considered at this meeting, and doubtless the questions will be settled upon a definite basis, satisfactory to all interests.

Dallas, Tex.

The telegraph and telephone business at Dallas, Tex., is the largest in the Southwest. More telephones are used in Dallas than in any other city of its size in the world, 7,500 instruments now being in use. The local business is handled through a main exchange and two branches, Dallas being the only city in the Southwest where it is necessary to have branch exchanges. The telegraph and telephone companies have their headquarters for the Southwest in Dallas. The city has seven steam railways, leading in thirteen different directions, and an interurban electric railway extending westward thirty-two miles. In 1904 the steam lines delivered at Dallas 834,479 tons of freight, and took out 393,756 tons. The long-distance telephone line recently completed between Kansas City and Dallas, passing through Indian Territory and Oklahoma Territory, is in fine condition. The report is that conversation over this line is of the highest possible degree of excellence.

The Animas Canal, Reservoir, Water, Power and Investment Company.

The Animas Canal, Reservoir, Water, Power and Investment Company, of Durango, Col., is installing a hydroelectric plant of considerable importance twenty miles from Durango, at a point affording an effective head of 970 feet. This head is available through 2,800 feet of pipe. The initial installation will consist of two 2,250-kilowatt General Electric generators, direct-connected to Pelton waterwheels. Provision has been made in the dam and headworks for an ultimate development of 30,000 horse-power. The present pipe line is of sheet steel, varying in diameter from forty-four inches at the upper end to thirty-four inches at the wheels. The thickness varies from three-sixteenths of an inch to eleven-sixteenths of an inch. The pipe is all double butt-strap riveted, with triple riveting at the lower end, and is provided with flanged connections. In this way an exceedingly heavy and substantial pipe construction is ensured. The waterwheel units—two in number—are of double overhung construction, each unit consisting of two turbine wheels, one overhanging each end of the main shaft, with the engine-type generator in the centre. Needle nozzles are used. These are operated by oil-pressure automatic governors, and ensure accurate regulation and economy of water at all stages of load. The wheels are approximately eight feet in diameter, with centres of cast steel, turned all over, and fitted with Pelton buckets straddling the periphery, and secured to the frame by means of turned steel bolts driven in reamed holes. The buckets are fine ground and machined inside to obtain the highest possible efficiency. Each wheel unit will have a maximum capacity of 4,000 horse-power, to provide for an overload on the generator.

The complete hydraulic plant, including pipe line and water-wheels, was manufactured by the Pelton Water Wheel Company, San Francisco, Cal., and the electrical equipment by the General Electric Company, Schenectady, N. Y. Mr. F. O. Blackwell, 49 Wall street, New York city, was retained as consulting engineer for the company.

Special Railroad Rate for National Electric Light Association Convention.

A number of enquiries are being made regarding hotel accommodations at the twenty-eighth convention of the National Electric Light Association, to be held at Denver and Colorado Springs, Col., June 6 to June 11. These enquiries should be addressed to the Committee on Hotel Accommodations, 405 Seventeenth street, Denver, Col. The personnel of the committee includes W. J. Barker, chairman; J. Hernan, J. J. Cooper, J. F. Vail, S. W. Cantril, H. L. Woolfenden, Philip Cross and J. C. Andrews, secretary.

The Western Passenger Association has named a rate of one fare plus fifty cents for the round trip from all points in its territory to Denver and Colorado Springs. This rate will apply only where a single fare is twelve dollars or more.

Annual Report of the American Telephone and Telegraph Company.

The annual report of the directors of the American Telephone and Telegraph Company to the stockholders for the year ending December 31, 1904, has been published. The following extracts from the report of President Frederick P. Fish shows the physical and financial status of the company. A curve is given showing the increase in number of subscribers' stations connected to the system of the Bell telephone companies from January 1, 1876, to January 1, 1905.

The results of the business for the year 1904 were as follows:

Gross Revenue	$18,546,659.21
Expenses, Including Interest and Taxes	7,270,957.46
Net Revenue	11,275,701.75
Dividends Paid	9,799,117.50
Carried to Reserve	586,149.20
Carried to Surplus	890,435.05

The following were the corresponding figures for the year 1903:

Gross Revenue	$16,545,632.39
Expenses, Including Interest and Taxes	5,980,967.30
Net Revenue	10,564,665.09
Dividends Paid	8,619,150.75
Carried to Reserve	728,139.97
Carried to Surplus	1,217,374.37

"The total mileage of wire for exchange and toll service was 4,671,038 miles, of which 712,147 miles were added during the year.

"Including the traffic over the long-distance lines the daily average of toll connections was about 301,000, and of exchange connections about 11,149,000, as against corresponding figures in 1903 of 258,000 and 9,876,000; the total daily average for 1904 of connections both toll and exchange reaching 11,450,000, or at the rate of about 3,687,000,000 per year.

"The total amount added to construction and real estate by all the companies constituting our system in the United States during the year 1904 was:

For Exchanges	$22,673,200
For Toll Lines	8,243,500
For Land and Buildings	2,520,000
	$33,436,700

"The amount added in 1900 was $31,619,100; in 1901, $31,005,400; in 1902, $37,336,500; and in 1903, $35,368,700; making the grand total of expenditure upon these properties during the five years, $168,766,400.

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

	1903.	1904.
EARNINGS.		
Dividends	$7,802,833.63	$8,400,301.18
Rental of Instruments	3,047,088.35	3,438,605.54
Telephone Traffic	4,888,158.34	5,575,447.90
Real Estate	73,332.15	76,782.49
Interest	734,219.92	1,055,522.10
	$16,545,632.39	$18,546,659.21
EXPENSES.		
Expenses of Administration	$962,297.84	$1,103,492.95
Legal Expenses	95,564.60	83,530.42
Interest and Taxes	1,993,680.08	2,670,083.61
Telephone Traffic	2,929,424.78	3,413,850.48
	$5,980,967.30	$7,270,957.46
Net Revenue	$10,564,665.09	$11,275,701.75
Dividends Paid	8,619,150.75	9,799,117.50
Balance	$1,945,514.34	$1,476,584.25
Carried to Reserves	$728,139.97	$586,149.20
Carried to Surplus	1,217,374.37	890,435.05
	$1,945,514.34	$1,476,584.25

"The net output of telephones during the year 1904 was 701,047, making the total number in the hands of the operating companies 4,480,564.

"The number of exchange stations at the end of the year operated by the companies which constitute our system was 1,799,633, an increase of 274,466. In addition to this number there were 167,213 exchange and toll stations operated by companies or associations under sublicense contracts and making use of our telephones. Adding also telephones employed for private-line purposes, our companies have a total of 2,003,213 stations.

"The amount expended by this company in 1904 for the construction, equipment and supplies required for its long-distance lines was $4,012,905, making the total investment in long-distance lines and equipment up to the close of the year $30,889,710.

"The development of the business during the past year exceeds that of any preceding year, and this applies not only to the increase of the number of subscribers in established exchanges, but to the toll-line development and the extension of lines and service into the more sparsely peopled sections of the different states. Present indications point to even a larger growth of the business for the year 1905.

"Every extension of the service brings in new subscribers and, what is of greater moment, increases the value of the service to those already connected. The demand for telephonic connection has spread throughout the entire country, so that today not only the smaller householders and business men, but even the isolated farmers in all parts of the country are coming to regard the telephone as a necessity. Its use on railroads, in factories, on steamships, and in other special environments is growing rapidly, and there is an enormous increase in the number of private branch exchanges in hotels, apartment houses and other large establishments where, by the use of the private branch exchange, the same telephones can be employed for intercommunication between the rooms or offices as well as to talk out upon the lines of the general system.

"It is gratifying to note that the service throughout the country is constantly improving, notwithstanding the enormously greater difficulty in carrying on the business on its present large scale. This is due in part to improvements in physical plant and to the adoption of better operating and maintenance methods, but even more to the more definite recognition that a high standard of service must be attained and to the more intelligent and careful supervision of the plant and of the operating which has come with experience and with a higher aspiration for good service.

"Involved in the extension of the business, both from the point of view of the companies and of the public, is the establishment of such schemes of rates as will result in an adequate return to the operating companies and at the same time will make it possible to graduate the cost of the service to the varying requirement of the respective subscribers and therefore be alike fair to the large and small user. In no other business that serves the public are the difficulties of dealing with rates greater than in the telephone business, particularly in view of the facts that in no two localities is the investment or the cost of operating per station the same, and that, as communities increase in size, conditions arise which largely increase these costs.

"The Bell companies are dealing with this question intelligently and on sound lines. By the adoption of measured service in places where it is applicable, and of different grades of service which can be supplied at varying prices to meet the

requirements of different classes of telephone users, they are promoting the necessary extension of the service on a basis that is safe, and satisfactory both to the companies and to the public. As a fundamental principle the large user should pay to some extent in proportion to his use, while the smaller user should be offered a service adapted to his needs at a lower price.

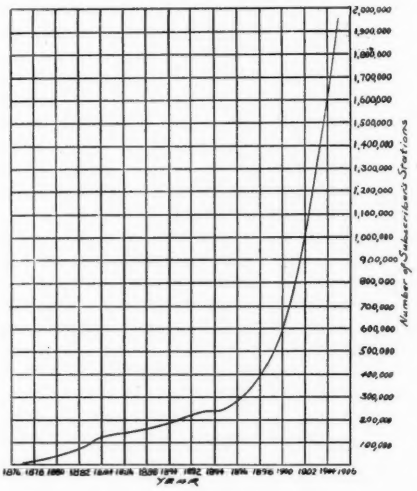
"The number of subscribers to the Bell system is now practically a hundred per cent greater than was the case three years ago. In almost every part of the country each subscriber is able to talk to twice as many stations, and through those stations to a very much larger number of people. Thus the value of the service to the user is constantly increasing, and its cost to the subscribers, in relation to its value, is constantly reduced.

"Moreover, the telephone users on the average pay a substantially less amount for the service they receive, irrespective of its increased value, than was the case three years ago. Not only are the standard rates reduced from time to time, wherever the conditions justify such a reduction, but a constantly increasing proportion of the telephones installed is furnished at the lower scale of rates adapted to the needs of those whose requirements are adequately met by the classes of service offered at such lower rates.

"Concurrently with this reduction of the average rate, and as a consequence of the continued application of sound methods of engineering and of operation, and of the extension of the business into fields where relatively expensive construction and high cost of operation are not required in order to render adequate service, there is a constant decrease in the average investment and cost of operation per station of the Bell system as a whole. This is not true of every locality, and the extent of this reduction, if any, in any given place, depends upon the local conditions; as for example, the size of the community and the density of its population, the proportion of the investment that is required in any special place for real estate, expensive underground construction, intercommunicating trunk lines or elaborate exchange equipment, and the character and extent of service that is demanded.

"As a general principle it seems perfectly certain that it will always be the case that the larger and more densely populated the community, the higher must be the standard of rates for the comprehensive service required for that community. Not only the investment and the cost of operation, but the general difficulty of doing the business which can only be overcome by enlarged expenditure, increase in passing from the smaller towns and cities to the larger.

"All these difficulties and expenses culminate in cities of the first rank. In those cities there is extensive underground construction, laid and maintained under unfavorable conditions and at great cost, the real estate expense is necessarily very high, the central office equipment is complicated and expensive out of all proportion to the number of subscribers served, there has to be a network of trunk lines connecting the different exchanges one with another, and there are many other conditions involving great expense that are not present to a proportionate degree in smaller communities. Moreover, the business is on such a large scale and the element of time so much more important as to require the maintenance of a much higher standard of promptness and efficiency in the service furnished than is necessary in a smaller community,



GROWTH OF TELEPHONE SERVICE OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

and this higher grade of service can only be attained at a disproportionate increase in cost. In fact, the conditions in those cities are such that only engineering skill of the highest order, and the courage to embody the result of that engineering skill in permanent construction and to practice the most sensitive methods of operating regardless of cost, even at times when there was a fair question as to whether the great expense involved was justifiable, have enabled our companies to bring the situation into such shape as to be able to render the amount and character of service that is now required of them. To-day there is no question as to their foresight, and it is certain that the telephone problem in the large cities, complicated and difficult as it is, can be worked out satisfactorily, whatever may be the demands for service.

"Even in the largest cities, however, not only the average rate per station, but the standard rates of the individual subscriber, have been reduced from time to time as the conditions warranted; and this policy will be continued as circumstances permit.

"In some places in the country, particularly where there has been the demoralizing effect of unintelligent competition, the rates are at the present time too low. The service rendered is worth substantially more than the users pay for it, and the net return to the operating companies in those particular localities is inadequate. In many such places the rates have already been raised to the point of reasonable return, with the goodwill and hearty cooperation of the community. There is no doubt that this process of readjustment will continue as the public becomes satisfied that it is the intention of our operating companies to increase rates only where it is necessary, and to reduce them as and when the conditions of the business justify it. That such is the policy of our companies will, it is believed, be recognized more clearly from year to year.

"The number of telephone companies organized to operate independently of the Bell companies in rural districts and relatively small centres of population, and for the most part in places not at the time having the Bell service, which have concluded that it is for their interest to become a part of the Bell system, is constantly increasing, and their course in entering into contracts with the Bell companies, whereby they take our telephones and connect with toll lines of our system, is significant as showing the growing appreciation of the value of the Bell service.

"On the thirty-first day of December, 1902, as appears from the admirable and complete bulletin of the Census Department relating to the telephone and telegraph industry of the United States, there were of the telephones classified as operated by independent companies, so-called, 84,021, which were in fact Bell telephones used under contract with the Bell companies and as part of the Bell system. This number has grown so that on January 1, 1905, there were, as above stated, 167,213 telephone stations of this class. There is every reason to believe that this sublicense business of the Bell companies will increase from year to year to the advantage of all concerned.

LINE CONSTRUCTION FOR HIGH-PRESSURE ELECTRIC RAILROADS.[1]

BY GEORGE A. DAMON.

The single-phase high-pressure trolley has arrived and evidently has come to stay. The advantages gained by delivering energy directly to a car without the necessity of an investment in synchronous converters and heavy feeders has long been recognized. That it is entirely practicable to take current from a high-pressure conductor by means of a moving contact has been fully demonstrated. It has required some time to show that there is a field for a single-phase traction motor sufficiently promising to justify its commercial development, but a number of motors of this type are now upon the market and within the last few weeks have been put in actual every-day operation.

To get the full benefit of the new system, it is desirable to carry as high a pressure as practicable on the trolley wire. It is apparent at once that the methods of installation which have become standard with the 500-volt system are inadequate for the new conditions. Several methods of supporting the high-pressure trolley wire have already been developed, and now the time has come to standardize the pressure and the location of the current conductor, as well as the method of current collection in order to provide for an interchange of equipment.

It is the object of this paper to present a brief record of what has already been accomplished in line construction, and to examine the requirements and difficulties of installation in order to obtain permanent insulation at reasonable cost, safety to the public, and reliability in service. It is important that a discussion be developed at this time which will at least indicate the tendency of the developments which are taking place. In order to allow an opportunity for the presentation of the details and advantages of certain systems which are being perfected by others, this paper is purposely left incomplete in certain parts.

THREE CLASSES OF CONSTRUCTION.

The successful use of a single high-pressure trolley wire will have a marked stimulus upon three distinct branches of the electric railroad art:

1. Moderate speed and inexpensively equipped electric lines for country districts.

2. High-speed interurban roads for service between large centres of population.

3. Electrification of steam railroads.

This will leave the city systems with their suburban extensions to be served, for the present at least, by the direct-current motor. In studying the methods of line construction, it will be desirable, therefore, to keep in mind that each of the three classes of roads indicated will have its own individual problems and requirements.

For moderate speed lines in the country districts, the full benefit of the high-pressure system will be obtained only when the first cost of such a road has been reduced to a minimum, consistent with good work. A study of the electric railway situation in the middle western states will emphasize this point. It will be seen that nearly all the territory which promises even a fair return on the investment has been preempted and that some roads are even now being built where there may be some doubt as to their being able to stand the fixed charges resulting from the cost of the illogical synchronous converter substation system. There are still left whole sections of rich productive agricultural districts which will remain unserved by a trolley road until a system has been developed which is so simple in its requirements that it can be built and equipped complete for less than $15,000 per mile, and operated on a basis equally economical. This class of installation means a trolley pressure as high as possible, as well as transformer substations operating without attendance and working in parallel from one transmission line.

For high-speed interurban roads the high-pressure trolley opens up new possibilities. Heavier cars with more powerful motor equipments can now be operated at high speeds between cities without prohibitive first cost. "Limited" electric train service with speed schedules of sixty miles an hour from the heart of one city to another will soon be in vogue, and without the necessity of changing from third rail to trolley in passing from private right of way at corporate limits. Roads of this character, with their better earning capacity, can afford such refinements in line construction as a sectionalized trolley, individual transmission lines to each substation, and separate pole lines for the trolley and the transmission systems.

The electrification of steam roads will present a different set of conditions. Here the steam locomotive will share the tracks with its electric successor for some time, and will do all it can with its acid-charged gases to destroy the handiwork of the electrical engineer. This will make the installation of a contact wire anywhere except at the side of the track a doubtful proposition, and thus calls attention more strongly to the statement that line-construction problems must be divided into classes.

LINES ALREADY BUILT.

It will be instructive to examine the details of construction of several high-pressure trolley lines already in operation. There are details available of three installations in Europe—Valtellina, Spindersfeld, and the Huber system. There are several other lines building in Europe, but either the details of the line work have not been disclosed or the systems adopted are similar to the ones described.

In this country the overhead equipment of the Lansing, St. Johns & St. Louis Electric Railway, the Indianapolis & Cincinnati Traction Company, and the Bloomington, Pontiac & Joliet Electric Railroad will present types, leaving the interesting work which has been done near Schenectady and at Pittsburg to be described and discussed by others.

Valtellina—This is really a three-phase road having two trolleys, but the line construction could easily be adapted for a single trolley. The line is sixty-six miles long, with three branches; is located near Milan, Italy, and has been in operation since September, 1902. The trolley pressure is 3,000 volts at fifteen cycles. The transmission line, at 20,000 volts, is carried on the trolley poles. The contact wires are fixed at a height of twenty feet in open stretches and at sixteen feet in tunnels. The trolley wires are hard-drawn copper wires of eight-millimetre diameter, and the span wires consist of galvanized steel wires of five-millimetre diameter. The span wires which hold the trolley wires, after the usual suspension method, are attached to the poles by means of porcelain insulators of a special type. The contact wire is suspended by ambroin insulators consisting of a cast-iron bell holding a steel bolt imbedded in ambroin and having a mechanical clip at its lower end. The insulators are tested to 10,000 volts.

On tangents and on curves with a radius greater than 3,000 feet, single-bracket poles are used; on curves the contact wires are suspended on double poles with span construction. At stations double-bracket poles are used. A peculiar detail is a circlet of iron with protruding

[1] A paper presented at the 195th meeting of the American Institute of Electrical Engineers, New York, March 24, 1905.

spikes to prevent people from climbing the poles.

The current collector consists of a roller of electrolytic copper of 3.125 inches diameter and 2 feet 1.625 inches long. The current is taken from the roller by contacts rubbing on both ends of the roller. One break of the contact wire on this line is reported, the wire falling on the roof of the car, which was thoroughly grounded and thus no harm was done.

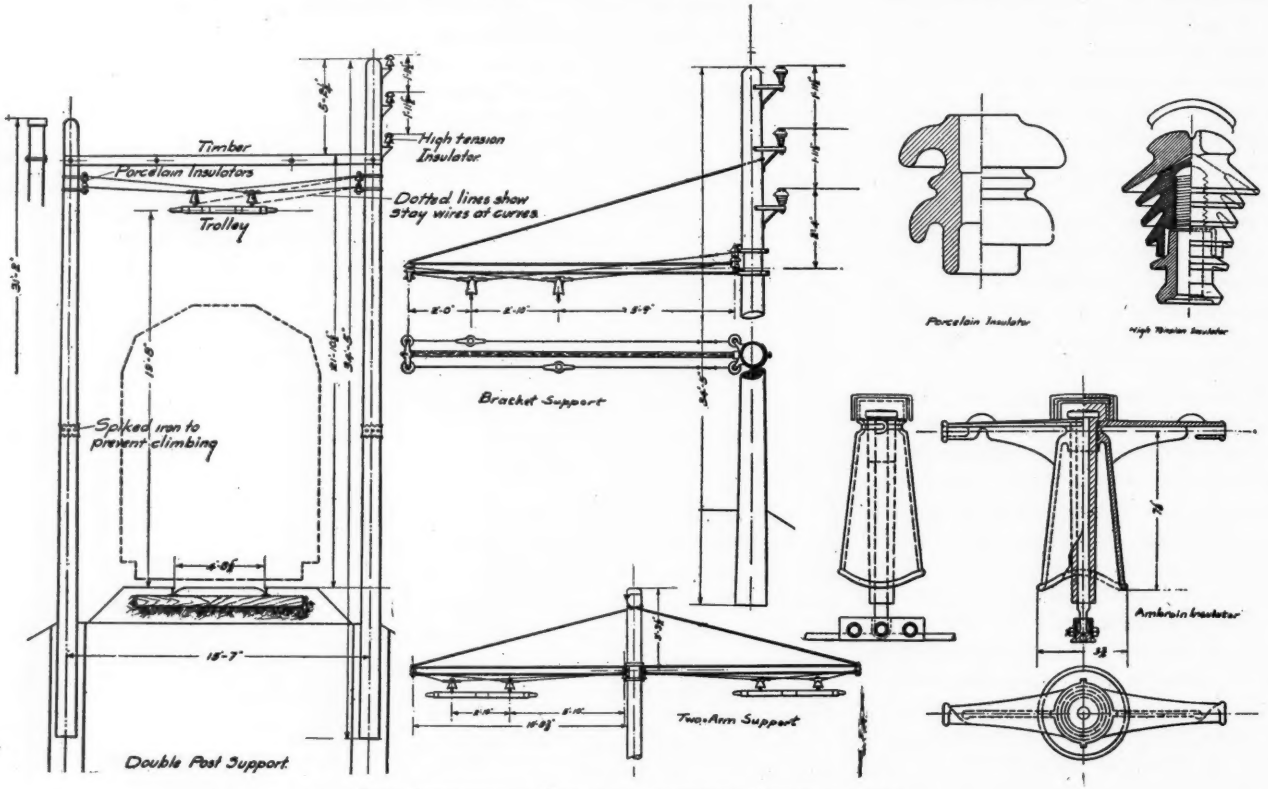
Spindersfeld—This is a single-phase experimental electric line installed on the state railroad near Berlin. The line is insulators and fastened to the bracket arms by means of special clamps.

Underneath the bridle wire there is an earthed bar, so arranged that a break in the line or in the catenaries will cause a contact to be made with the live conductor, grounding the system and throwing a circuit-breaker and thus protecting the line.

All telegraph, telephone, and other wires passing over the trolley are protected by a wire cage which completely surrounds them in order to prevent any possibility of their coming in contact with the high-pressure railroad conductors.

ductor wire. The illustrations indicate diagrammatically the various relative positions of the collecting device and the wire.

In making contact with the wire when over the car the collector arm rubs beneath the wire, but this is only done in tunnels and in other contracted spaces. The current collector is mounted on porcelain insulators and the light arm is held in place in such a way that it can readily be removed and renewed. The entire device is further mounted on a parallel link motion, which is controlled automatically so as to shift the centre of



LINE CONSTRUCTION DETAILS, VALTELLINA RAILWAY, ITALY.

three miles long; it was put in operation in June, 1903. The trolley pressure is 6,000 volts at twenty-five cycles, single-phase system. The trolley wire is hung from two steel catenary wires with suspensions every ten feet. The steel wires also act as current conductors.

The copper wire is of eight-millimetre diameter; this seems to be the standard size on foreign roads. This wire is slightly smaller than No. 0 B. & S. gauge. The contact device is a sliding bow. On parts of the line a single catenary suspension is used, the double catenary being a later development, having been adopted to ensure greater safety and to increase the lateral rigidity of the conductor. The catenary wires are attached by short rubber chains to a bar mounted on two

Huber System—An experimental line has been built by the Oerlikon Machine Works after the plans of E. Huber, technical director of the company. The line uses a single-phase current at 14,000 volts directly on the conductor wire. The current-collecting device is of novel design; it consists of a curved metallic stem with its convex surface bearing lightly on the top of the current-carrying conductor. Normally the wire is located at the side of the car, but in passing through a tunnel or under an overhead crossing, the wire can be brought over the centre of the track. The collecting stem has a rotary motion in a plane perpendicular to the track; the position of the stem at any time is regulated automatically by the location of the overhead con-

rotation of the contact stem when required.

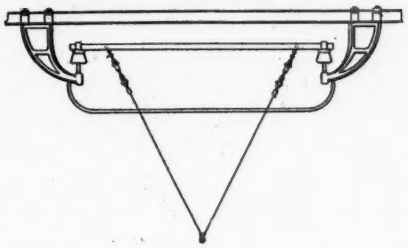
The side wire is carried in mechanical clips held in place on the top of the poles by special porcelain insulators made large enough to stand a test of 30,000 volts. The entire line has withstood a test of 16,000 volts. The average height of the contact wire alongside of the track is fifteen feet and inside tunnels 16.5 feet. The distance between supports is about 100 feet.

The Huber system is being installed upon the Seebach-Wittingen line, where its operation will be watched with more than ordinary interest.

Swedish State Railroad—It is instructive to note that upon the experimental line authorized by the government of

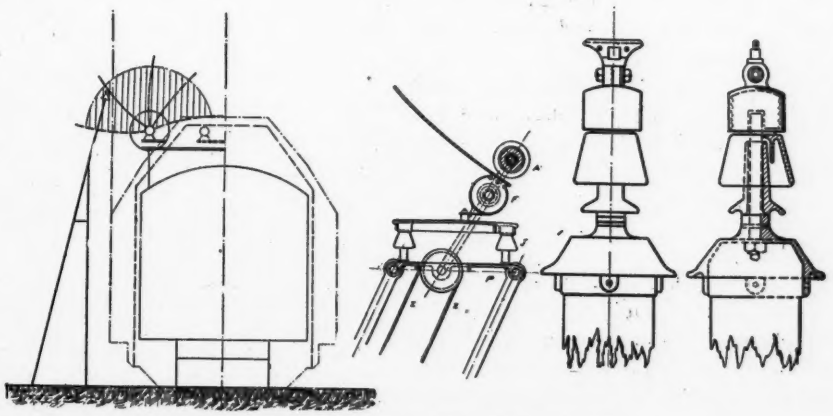
Sweden, and now building, a pressure on the contact wire of 6,000 volts at twenty-five cycles will be used.

Lansing, St. John's & St. Louis Electric Railway—This was the first single-phase electric road to be built. It runs twenty miles north from Lansing, Mich.



DETAIL OF CATENARY CONSTRUCTION, SPINDERSFELD ROAD, GERMANY.

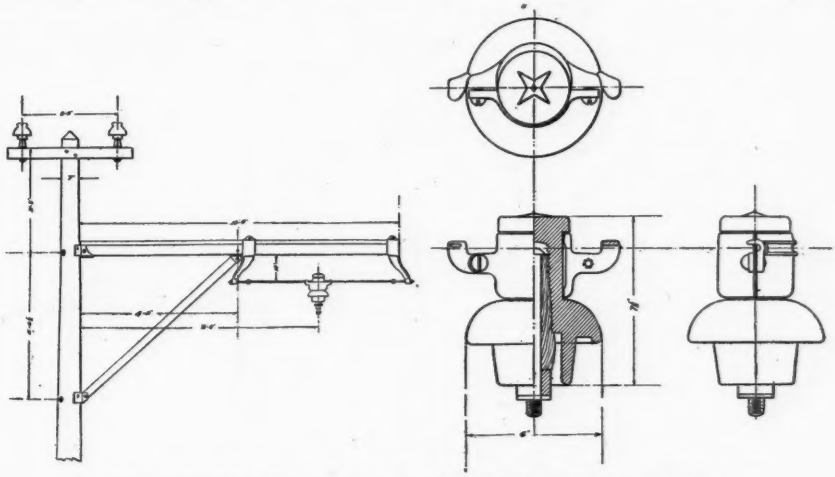
The line was the scene of the pioneer single-phase work done by Bion J. Arnold in 1900-1904. The line has been operated with a pressure of 6,000 volts on the trolley wire. The general method of suspending the trolley wire followed in direct-current work was adopted for this line, but the usual hanger was replaced with a large special insulator of annealed glass, tested to 30,000 volts. This special hanger was held in place on a flexible cross wire suspended between malleable-iron brackets attached to a wooden cross-arm. It was originally intended to stagger the wire supports and use a bow collector, but the experiments were finally conducted with the use of an ordinary trolley wheel. This wheel would at times slip off the wire, and the breaking of the glass hanger insulators from this cause soon demonstrated that this form of suspension was not adapted for places where there was any probability of an ordinary trolley wheel being used.



HUBER SYSTEM OF LINE CONSTRUCTION.

This line proved, however, that the use of trolley pressures as high as 6,000 volts were entirely practicable; and the attention which was attracted to single-phase possibilities by the early work done at Lansing had a marked influence in creating the demand for the general development of high-pressure railroad systems.

Bloomington, Pontiac & Joliet Electric Railway—This line will be ninety miles long, connecting Bloomington and Joliet, Ill. A section of the line was put in operation February, 1905. The trolley pressure is 3,300 volts, and the wires are held in place by catenary construction. Owing to local conditions, such as turnouts, there are two No. 00 grooved trolleys over each track, each hung from a 0.375-inch galvanized steel cable. The poles are so placed that eventually they will be in the centre between a double track. The brackets holding the catenary insulators are made of Washington fir, with a wooden brace underneath. The insulators are cemented on iron pins.



LINE CONSTRUCTION, LANSING, ST. JOHN'S & ST. LOUIS ELECTRIC RAILWAY.

Indianapolis & Cincinnati Traction Company—This is a high-speed interurban line, forty-one miles of which are practically finished. Sixteen miles were put into service January, 1905. The trolley pressure is 3,300 volts. The catenary form of suspension is used with one 0.4375-inch steel messenger wire supported every 100 feet by large flat insulators held on an iron bracket. The copper trolley wire is No. 000 B. & S. gauge and is carried eight inches under the messenger cable. The trolley is supported every ten feet by means of special steel clamps in such a manner that the wire is held very nearly at a perfect level over the centre of the tracks and eighteen feet above the rail.

The transmission line pressure is 33,000 volts; a separate pair of wires connects the power-house with each sub-station. The trolley pole-line and the transmission pole-line are separate, the former being at one side of the right of way. The iron brackets holding the catenary insulators are made of angle iron with a loop at the outside; this will allow for considerable adjustment in the position of the insulator. It is the intention to stagger the position of the catenary supports and thus produce a horizontal wave in the trolley line, which will distribute the wear on the bow collector, eventually to be used on this line.

The trolley wires are suspended from the steel catenaries by means of special mechanical clips attached to the wires every eleven feet. In Pontiac iron poles are used and a special insulator has been designed for the support of the cross-suspension wire. Above the trolley in city streets a lighter catenary construction is placed for protection in case the trolley wire should break; but most of the strain is carried by the regular cross-suspension wires.

REQUIREMENTS OF INSTALLATION.

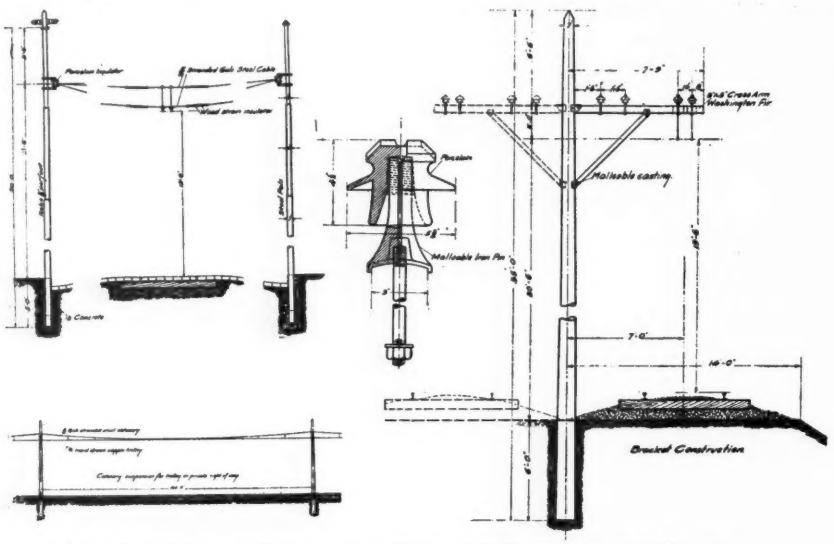
Bearing in mind the distinct requirements of the three classes of roads already referred to, the problem of line construc-

tion may be discussed under the following heads:

1. Pressure and insulation.
2. Location of conductor.
3. Requirements for safety and stability.

As an entire paper might be devoted to any one of these subjects, there is offered an opportunity for considerable discussion.

Pressure and Insulation—The single-phase lines now in operation in this country have 3,300-volt trolleys, and several lines under construction have also decided to use this pressure. From present appearances, therefore, 3,300 volts is to be the standard for interurban lines. It would be well, however, to consider just at this time whether it would not be advisable to use a trolley pressure of 6,000 volts. From an operating standpoint there seems to be no reason why this higher pressure is not just as practicable as a lower one; and to get the full benefit of all the advantages inherent with the high-tension system the higher pressure should be adopted.



LINE CONSTRUCTION, BLOOMINGTON, PONTIAC & JOLIET ELECTRIC RAILWAY.

Even if a few of the first roads are built with a 3,300-volt trolley, there is no reason why, with the catenary suspension, the insulation provided should not be capable of standing a working test of 6,000 volts, so that when the time comes to double the pressure the expense of the change will be a minimum.

For steam-railroad conditions, the larger amount of energy required indicates that a pressure of at least 15,000 volts will probably be desirable. Just where to strike a balance between the cost of copper and the cost of insulation for steam-road work is a problem which should be carefully worked out; but there seems to be no reason at this time why pressures of over 10,000 volts should not be considered.

The catenary form of suspension affords so convenient a method of insulation that it should become standard practice for interurban electric lines. When selecting an insulator for this construction, mechanical strength should be the first consideration, and a few cents more spent on the insulator will ensure an abundance of insulating qualities. As far as insulation is concerned, there is no reason why the catenary construction could not be operated at more than 30,000 volts, if desired. For pull-offs and cross suspensions to iron poles special porcelain insulators are being designed and used with success.

It has long been admitted that dry wood is one of the best insulators. The convenience with which a wooden rod fitted with suitable terminals can be worked into an overhead construction will commend this form of insulation. Impregnated with an insulating compound, and of sufficient length to withstand high-pressure tests, the long wooden insulator is applicable to the insulation of guy wires, and cross-suspension wires. Its use in actual practice will be watched with interest.

The use of a wooden bracket to hold the insulator for supporting the catenary will probably appeal to some as a step backward. As far as looks are concerned, however, it may be said that a wooden bracket of a section 3.5 by 5 inches presents an appearance fully as attractive as the ordinary cedar pole to which it is attached; and that a double-track road with a line of centre-poles equipped with wooden brackets will be much less offensive from an æsthetic point of view than a double row of side suspension poles raked outward in the usual fashion.

The wooden bracket has an element of safety not possessed by an iron support, as the insulating properties of the wooden arm would be useful in the case of the failure of an insulator. Unless the wooden bracket were wet it would safely hold up a 6,000-volt catenary until the line could be repaired.

LOCATION OF CONDUCTOR AND COLLECTOR SYSTEMS.

For moderate speed roads the natural tendency will be to have the trolley wire where it has proved to be so thoroughly satisfactory; that is, over the centre of the track, and to continue to use the present trolley-harp and wheel. For speeds not exceeding forty to fifty miles an hour at trolley pressures up to 3,300 volts, this arrangement will work satisfactorily.

For high-speed electric lines there will be little objection to the conductor wire remaining over the track, provided it is properly suspended; but the danger of the ordinary trolley wheel jumping off the wire at high speeds will, no doubt, suggest the use of some form of collector other than the wheel. The bow, the roller, and the shoe will each find advocates until more experience has been obtained and the results are reported and discussed.

Special cases will arise such as the installation of a high-pressure conductor wire over a road already equipped with a direct-current trolley, as was the case with the Ballston, N. Y., road. In such an event the catenary construction can be very nicely adapted to suspending the wire at the side of the track. This location could be advocated for an entirely new installation on the grounds of cheaper first cost and some additional safety in case the wire should break and fall, but both these arguments lack sufficient weight to establish the wire in the side position as standard practice.

For steam-road conditions considerable objection may be found to locating the conductor wire over the centre of the track: the danger to trainmen standing on top of the cars; the fouling of the conductor; the deterioration of the insulation, and the destruction of the wire and supporting cables by the gases of locomotives which may jointly occupy the tracks; the blocking of traffic when it is necessary to repair a broken wire—all these are serious drawbacks to this location of the conductor for heavy railroad practice. To avoid the deleterious effect of the locomotive gases it would seem to be imperative to place the contact wire at one side

and as low as possible consistent with general safety. The advisability of installing an independent and duplicate system of conductors is also to be considered for lines of importance; this can be done only by putting the wires on opposite sides of the track.

The Huber system appears to have been carefully worked out, and at the present time is the best suggestion for a solution of the line problems in connection with the electrification of steam roads. There is one serious objection to the arrangement, but this can be overcome. The contact wire carried from pole-top to pole-top is liable to break, and some form of support should be devised to prevent the broken ends falling to the ground. A double-catenary suspension system with one wire carried on an insulator at each end of a cross-arm attached to the pole, say a foot from the top, could be provided, and the contact wire could be supported from the apex of triangular supports attached to the two catenary wires. This method would offer advantages over any system of guard-wires or cradles which might be devised to catch the broken wire, as it would require three wires to be broken before any part of the system could fall to the ground.

REQUIREMENTS FOR SAFETY.

Frequent Supports—Whatever method of construction is followed, every precaution should be adopted to prevent accidents to the public or employés from the loose ends of a broken live wire. Suspensions or supports properly installed every ten to fifteen feet will lessen this danger.

With bracket construction having poles about 100 feet apart, there will be no need of a double-catenary suspension for the wire which is to be used with an underrunning collector. In such a case, the double suspension would mean twice as many insulators as would be required with the single catenary, thus decreasing the insulation resistance and increasing the chances for trouble. With what is known as the "tower" method of construction—using long spans—the double catenary, spreading at the points of insulated supports and converging together at the centre of the span, will be found desirable. The necessity of keeping the wire from swaying will justify the double catenary in this case, and the fact that the number of points of support is reduced by using long spans will more than balance the use of two insulators at each support.

The frequent clips holding the contact wire are not only advantageous from the standpoint of additional safety, but they contribute to the permanency of the construction by keeping the wire almost perfectly horizontal at all temperatures, and thus avoiding the bending of the wire up and down at the support points every time the collector passes. The only disadvantage to clips holding the wire every few feet is the tendency for the trolley wheel to spark at these points. This is not a serious objection if a collector similar to the bow device is used, in which case there will be no interference between the collector surface and the mechanical clips.

Protection from Sleet—In a hard sleet-storm every attachment connected to the wire will naturally be the cause of additional trouble. The arcs due to a coating of ice between the wire and the collector will be much more vicious at 6,000 to 15,000 volts than at 500 volts, but there is no occasion to become alarmed at the possible danger from this source. In this country one of the high-pressure lines using a trolley wheel on a 3,300-volt wire has already passed through a hard siege of sleet; and though the sparking was spectacular, very little damage was done. The frequent trolley supports, however, added considerably to the sparking.

Greased trolley wires are sometimes used to prevent the trouble caused by sleet; it would be interesting to learn the experience of members of the Institute with this device. It is well known that the grease finish of an aluminum wire prevents the collection of sleet upon the wire, and it may be possible that a coating of grease on the high-pressure conductor wire would entirely obviate this trouble. It is evident that with a collector taking the current by means of a contact made on the top of the wire, as in the Huber system, the trouble from sleet would be a minimum. In those kinds of sleet-storms in which icicles are formed and hang from the wire, a top-bearing collector would have every advantage, but when the sleet freezes equally all round the wire, the lighter pressure of the top-bearing contact might put the Huber collector at a disadvantage.

Transmission Lines—The transmission lines from the power plant to the substations will be at a higher pressure than the trolley pressure, and will therefore require careful treatment. For a road which is to be built economically, a single set of transmission wires serving all of the static transformer stations in parallel will be sufficient. These transmission wires will ordinarily be carried on the tops of the same poles which support the trolley bracket.

The next refinement would be to have a separate set of transmission lines from the power-house to each substation, making it possible to put the overload protective devices on the central station switchboard and thus eliminate the substation attendance. With this multiplicity of wires and consequent higher first cost adopted, it is but one step farther to separate entirely the two systems and to install two pole lines on the same right of way; where the electric road is of the high-speed class this should be done.

To be consistent, however, in ensuring safety to the public, it would be well to advocate as standard practice the plan of carrying the high-pressure transmission lines entirely around small towns and cities instead of through them. If the transmission lines are too dangerous to be carried on the railroad company's trolley poles, then there is more danger in carrying them along the streets and over the network of telephone wires inside the corporate limits. The problem of the proper regulation for this situation is one that will shortly have to be faced.

The first investment in the transmission line, the cost of maintenance, and the loss by leakage—all these can be cut in half by thoroughly grounding one side of the single-phase transmission line so as to use the earth as one leg of the circuit. An actual trial of this suggestion to further simplify the distribution system is under contemplation, and no doubt will furnish valuable information as to its effect on telephone and telegraph lines as well as data in connection with the resistance of the earth with alternating currents.

Grounded Guard Wires—Where the transmission lines pass over other wires, there should be a cradle of grounded wires to prevent a broken transmission line from coming in contact with a foreign wire. This cradle will be of little use unless it is of ample dimensions. Some effort has been made on European roads so to install grounded wires that the breaking of a conductor would at once cause the live end of the wire to make a contact with the grounded guard-wire, but in two cases which have come to notice the grounded guard-wire caused more trouble than it eliminated; for this reason it was soon abandoned. In order to encourage the discussion of the unsettled features of line construction for high-pressure electric railroads, the following are offered as

GENERAL CONCLUSIONS.

1. There are no reasons why the standard pressures of the conductor wire for interurban electric lines should not be at least 6,000 volts; this is suggested as a standard in order to provide for interchange of equipment.

2. For the electrification of steam roads a pressure of about 15,000 volts on the conductor wire is desirable.

3. For electric interurban lines, the present tendency is toward the catenary form of suspension, with the trolley over the centre of the track. A connection should be made about every ten feet, between the steel catenary wire and the trolley wire.

4. For steam-railroad stations a contact wire at the side of the track appears to offer the greatest advantages. Some form of construction should be adopted, however, to prevent the falling of the conductor in case it should break.

5. A successful bow collector for interurban work and a contact arm for steam-road installations similar to that in use by the Huber system would allow the location of the contact wire to be standardized.

6. A trolley wire twenty feet above the centre of the track is suggested for interurban roads. For steam-road electrification the height of the contact wire at the side of the track could be made standard at sixteen feet.

THE NEW FEDERAL TRADE-MARK LAW.

BY JAMES HAMILTON, M. E., LL. B.

When one considers that a trade-mark is closely akin to the good will of the business in which it is used and that the use of trade-marks bears a very close relationship to commerce, the importance of new legislation affecting trade-marks becomes apparent to every one engaged in commerce. The responsibility resting upon the committees on patents in recommending a trade-mark measure was fully appreciated by them and it was only after the consideration of numerous bills and the holding of many hearings that the present measure was recommended by them for passage. The new law was approved February 20 last, and goes into effect April 1 next.

There is no express authority given by the constitution to Congress to legislate upon the subject of trade-marks and the power to do so has been ascribed to various clauses of that instrument. At the time of the passage of the trade-mark law of 1870 (the first on the subject), it was thought by its framers that the authority was to be found in the clause which gives Congress power to legislate for the protection of patents and copyrights. But Justice Miller pointed out in the opinion handed down in the Trade-Mark Cases (100 United States 82) that this clause had for its object to protect the fruit of intellectual effort—as the result of ingenuity in devising some new and useful thing in aid of industrial development; or the production of some work of literary or artistic merit. But a trade-mark depends for its value not at all upon its novelty or utility in the arts, or upon the degree of ingenuity involved in its production, or upon its literary or artistic features; it need not and generally does not tend to promote the progress of science and the arts. It is sufficient that it indicates origin and ownership of the goods to which it is affixed and the right to it arises from and depends upon mere priority of adoption and use. The law of 1870 was held unconstitutional as being too broad in its scope and beyond the powers of Congress to enact. The present law, enacted in 1881, followed the law of 1870; and the report of the committee having it in charge shows that Congress at that time was of the opinion that the power to legislate upon the subject of trade-marks came within the treaty-making power and was based not at all upon the power given to Congress by the commerce clause of the constitution. For that reason the provisions of the act still in force relate solely to commerce with foreign nations and with Indian tribes. Its constitutionality has never been drawn in question; but in Warner *vs.* Searle & Heroth Company decided in November, 1903, it was held that in order to maintain an action for infringement not only must the owner of the trade-mark registered be using it in commerce with foreign nations or with the Indian tribes, but that the infringing use must be made in such commerce also. This decision made most clear the limited protection given by the present statute. The new law was passed under the belief expressed in the report of the committee of both houses that the power to legislate in regard to trade-marks is found in the commerce clause of the constitution, which gives Congress power to regulate commerce among the several states and with foreign nations and the Indian tribes. In the Trade-Mark Cases (100 United States 82) the Supreme Court expressly refused to pass upon the question whether such power is to be found in the commerce clause; but the argument presented in the committee's report leaves no doubt in one's mind that the relationship borne by trade-marks to commerce in general is such that the power to regulate commerce between the several states and with foreign nations and the Indian tribes carries with it the power to regulate trade-marks used in such commerce.

One of the most important changes made by the new law is the extension of protection to trade-marks used in commerce among the several states. After April 1, 1905, trade-marks used in interstate commerce may be registered equally with those used in foreign commerce, and an action may be maintained under the new law whenever the infringing use takes place in interstate commerce.

The government fee has been reduced from twenty-five dollars ($25) to ten dollars ($10), thereby reducing materially the cost of registration. This reduction will tend to make the registration of trade-marks more general and thereby give the public notice of what trade-marks have been appropriated to exclusive use.

An important change has been made by the new law in the matter of procedure for the registration of a trade-mark. Under the present law and practice, an appeal may be taken to the commissioner of patents in person from the adverse decision of the examiner of trade-marks as to registrability and the commissioner's decision is final. By the new law an appeal is allowed from an adverse decision of the commissioner to the Court of Appeals of the District of Columbia consisting of three justices, thereby ensuring the building up of a uniform system and the establishment of uniform rules governing and controlling the registration of trade-marks and doing away with conflict of decisions under different commissioners, about which so much complaint has been made in the past. A like change has been made in the procedure on appeal in trade-mark interferences.

Under the present law and practice only technical trade-marks may be registered; that is, trade-marks which are in nature arbitrary, fanciful and non-descriptive. But the courts have granted relief under the equitable doctrine of unfair competition, in many cases involving the wrongful use of trade-marks which could not be registered under the strict rule of present Patent Office practice; for instance, in the case of trade-marks which are descriptive or geographical in character but which from long use have come to be recognized by the trade as indicating the origin and ownership of the goods to which they are affixed. The new law conforms to the policy adopted by the courts in such cases and provides for the registration of all marks that have been in actual use as trade-marks for a period of ten or more years.

Registration under the new law is not compulsory. The right to exclusive use of a technical trade-mark is founded upon priority of adoption coupled with continuous use and depends not at all upon statute. The ownership of a trade-mark is the ownership of property at common law and trespass upon the owner's rights by wrongful use is a good cause of action either at law for damages or in equity for an injunction and an accounting of profits and damages. To protect owners who have not registered their marks, the new law provides that when an application is filed and the trade-mark therein described is upon examination found registrable, the commissioner shall cause the mark to be published at least once in the *Official Gazette* of the Patent Office. Owners of unregistered marks are thus kept informed of the filing of applications for registration of marks identical with or closely resembling their own and upon the filing of such a mark may within the period of thirty days file an opposition to the registration of the applicant's mark and, upon a proper showing to the commissioner, prevent the registration. Registration is made *prima facie* evidence of

ownership; but even if no opposition is filed and the applicant's mark is registered, the true owner of the mark may rebut the presumption arising from the registration and prove his ownership at common law arising from priority of adoption and use. He may do more. He may under the new law apply to the commissioner to have the registration of the conflicting mark cancelled. The commissioner thereupon refers the matter to the examiner of interferences for determination, and if the petitioner prevails, the registration is cancelled. The proceeding for cancellation is really supplementary to the proceeding on opposition and serves to safeguard the rights of true owners of unregistered marks who have missed seeing the publication in the *Official Gazette* and have, therefore, allowed the conflicting trade-mark to be registered.

Since registration is not compulsory, and since the true owners of unregistered marks have still all rights under and given by the common law, of what value is registration? In the first place, registration gives public notice of the appropriation to exclusive use of the trade-mark. Second, it furnishes *prima facie* evidence of ownership. Third, it gives the registrant the right to bring his action against the infringer in the United States courts. Fourth, in case the action is brought at law under the new law, the court may in its discretion treble the damages awarded by the jury. Under the common law the owner of an unregistered mark must be content with the damages awarded by the jury. Fifth, in case the action is brought in equity asking for an injunction and accounting of profits and damages, under the new law, the complainant in the accounting has to prove only the sales made by the defendant, and it is for the defendant to prove all elements of cost. In a suit in equity upon an unregistered mark, the complainant has the burden of proving exactly what profits accrued to the defendant and what were the actual damages sustained by the complainant, without aid from the defendant. Sixth, where the suit is under the new law upon a registered mark, the court may order the defendant to deliver up all prints, labels, receptacles, etc., bearing the infringing mark to be destroyed. This follows an analogous provision in the copyright statute. No such remedy is given under the common law to the owner of an unregistered mark. Seventh, where an injunction has been issued after hearing and notice to the defendant, the writ may be served upon him anywhere in the United States in case the suit is under the new law upon a registered trade-mark; and in case the injunction is violated, an action for contempt may be brought in any United States court. In the case of an unregistered mark the proceeding for contempt must be brought before the court issuing the injunction. In the case of a registered mark, the defendant can not remain in the United States and escape service under these provisions; in the case of an unregistered mark he may do so, for the above provision is limited to proceedings under the new statute.

A consideration of these advantages will show that the new law gives to registrants so many benefits not to be obtained under the common law and at so low a cost that no owner of a trade-mark can afford to allow his trade-mark to remain unregistered. If he does not register, he is bound, if he desires to prevent another from registering his mark or one closely resembling it, to scan the *Official Gazette* closely every week, and in case a conflicting mark is offered for registration, to go to much expense in maintaining the opposition. Were the trade-mark registered, the Patent Office would reject the conflicting application upon the prior registration, and the applicant could obtain registration only by engaging in an interference proceeding in which he would be the junior party with the burden of proving his case beyond a reasonable doubt. And in case the owner of the unregistered mark desires to have a conflicting certificate of registration delivered up for cancellation, he must engage in the expensive proceeding of proving his case; whereas, had the mark been registered by him, the conflicting certificate would have never been issued to his competitor.

Will the owners of trade-marks registered under the law of 1881 (now in force) be entitled to the benefits conferred by registration under the new law without again registering? They will not. That was made clear at the hearings before the committees having in charge this new law. To have given the added protection to registrants under the present law would be to have given the certificates a force and effect which they did not have at the time of their issue, and it was decided this could not be done. Such certificates when renewed, however, "shall have the same force and effect as certificates issued" under the new law. Until such renewal or until the mark is re-registered, the certificate has only the force and effect that it has under the present law, and suit can not be brought under it unless the wrongful use is made in foreign commerce, or commerce with the Indian tribes; actions for contempt in violation of an injunction can not be heard before any court other than the one issuing the writ of injunction; treble damages can not be imposed in the discretion of the court; and the complainant must prove exactly the profits made by the defendant. The wisdom of re-registering the mark need not be further enlarged upon.

The new law makes our statutes conform to treaty stipulations entered into between this country and certain other governments, and particularly provides for giving full force and effect to the provisions of the convention for the protection of industrial property to which the United States became a party in 1887. The foreign owner must first register in his own country before being entitled to registration here; but he need not have made use of the mark in commerce with this country. The new law provides that no goods bearing a false or counterfeit mark shall be allowed entry at any custom-house of the United States, and the foreign registrant has equally with the citizen registrant the right to stop importations into this country of goods bearing an infringing mark.

Congress has no power to legislate as to trade which takes place wholly within a state; hence, a trade-mark which is used wholly within the boundaries of a single state can not be registered under the new law, and an infringement which does not go beyond the confines of a single state can not be reached under the new law. To each state is left by the constitution the control of commerce which takes place wholly within its own borders, and, hence, the control of trade-marks used in such commerce. Nearly all the important states except New York, Ohio and Kentucky have passed general laws for the protection of owners of trade-marks and labels, and the three states excepted have passed laws giving such protection to trade-marks used in certain trades, as bottlers', distillers' and lumbermen's marks. The state laws are more liberal, in general, than the new federal law, and almost without exception provide for punishment by fine and imprisonment of persons using counterfeits of registered marks. A penal provision is conspicuously absent from the new federal law, it having been decided in view of the opposition expressed to omit such a provision from the new law at present and to leave it to be inserted by future legislation should the necessities then demand such an amendment.

Complete protection of a trade-mark can be obtained by registration under the new federal law in the United States Patent Office, and under the trade-mark laws of those states which are important to the owner by virtue of the bulk of his sales being made therein. The federal registration protects in commerce among the several states, with foreign nations and the Indian tribes; the state registration in commerce restricted in its field to the territory of the state of registration. As to what is included under the new law as within the territory of the United States for the purposes of the act it may be said that any territory under the control of the federal government is within its scope, and includes, therefore, Porto Rico and the Philippines.

American Institute of Electrical Engineers.

At the 195th meeting of the American Institute of Electrical Engineers, held at Carnegie Hall, New York city, Friday evening, March 24, two papers were presented and discussed, both dealing with the new types of line construction which have been developed to meet the requirements of the single-phase alternating-current system.

The first paper was by Mr. Theodore Varney, and was entitled "High-Pressure Line Construction for Alternating-Current Railways." Mr. Varney described the different types of construction. The new methods of suspending trolley wires differ most radically from the older methods found suitable for direct-current supply in the use of a messenger wire and a catenary suspension of the working conductor. This suspension gives flexibility, but it has been found advisable to prevent excessive lateral deflection by means of "steady strains"—rods which take up the lateral thrust. This method of suspension and the higher voltages employed in alternating-current railway work necessitate new types of insulators. In some systems a double catenary suspension is used, which tends to prevent lateral deflection of the working conductor. A brief reference was made to collecting devices. It is said that there are forty miles of road using single catenary suspension in operation in Indiana. This line has been running successfully since the first of the year. Sixty additional miles of road will be completed in the near future. The pressure used is 3,300 volts. The more complicated catenary suspension had been developed, with a view to obtaining a system of overhead construction for moderate and heavy traction service which will approach, in a far greater degree than heretofore, the reliability and permanency of present railroad equipment.

The second paper of the evening was by Mr. George A. Damon, of Chicago, and was entitled "Line Construction for High-Pressure Electric Railroads." In the absence of the author, it was read by Professor George F. Sever. The paper appears on another page of this issue. It gives a concise review of different types of overhead construction which have been developed in this country and in Europe.

Mr. F. N. Waterman, New York city, opened the discussion by giving a fairly complete description of the Ganz system, which is in use on the Valtellina road in Italy. This system has been under trial for four years, and in actual operation for two years. Mr. Damon, in his paper, speaks of the value of dry wood for overhead construction. Mr. Waterman said that this material is used to a large extent in the Ganz system, where it is employed for taking up strains and for cross-arms. The links in the catenary suspension are also of hardwood. The speaker referred to the difficulty of obtaining good mechanical and electrical construction in tunnels, where the moisture collects on the insulators, and where fouling occurs, due to the passage of steam locomotives. This has happened on the Valtellina road, during a period of heavy work when it was found necessary to supplement the electric locomotives by steam locomotives. This made it necessary to clean the insulators ever so often. The use of double insulation between the wire and the ground was important. As the Ganz system employs three-phase currents, there must be two working conductors, but these are suspended by two messenger cables. There are but two suspensions between the cross-arms, and one directly under the cross-arms. This gives uniform flexibility along the entire wire. When passing switches and cross-overs it is customary to lower the collector, unless the train is making up time. The collector is described in some detail. This consists of a horizontal hardwood rod, upon which are placed two bronze cylinders carried on ball bearings. This collector has been found to work satisfactorily at speeds as high as sixty-two miles per hour, when collecting 100 amperes. The rotation of the collecting cylinders prevents wear on the wire. The life of these bronze collectors has not yet been determined. Examination of the ball bearings after long use shows no apparent wear. It is said that the cost of maintaining this construction is $102 per mile per year. When the system was first put into service, all the signaling and telephone systems of the railroad were put entirely out of service, due to the ground return. It was found, however, that if the telephone and signaling grounds were carried down through earthenware or hard-fibre pipes to a depth of thirty feet, this trouble was eliminated.

Mr. Calvert Townley, New Haven, Ct., thought that it was not wise to jump at once to higher voltages, as had been suggested by Mr. Damon. At the present time 3,000 volts on the trolley is sufficient, and going higher is merely inviting trouble, without sufficient compensating gains. He does not think that the time has yet come for standardization. There are many requirements to be met which are not at once obvious. For example, it is probable that higher voltages will not be allowed within cities or villages. This would complicate matters with a high-voltage system. The danger to employés and others must also be considered, and any increase in voltage be made only after careful consideration.

Mr. A. H. Armstrong, Schenectady, N. Y., agreed with Mr. Townley as to the inadvisability of using higher voltages. Three thousand volts will do the work; to raise it increases the cost of the line construction and the danger to the system and to individuals. In his opinion, 3,000 volts is high enough at the present time. Using this potential on the trolley enables power to be supplied to the road for twenty miles on each side of a substation. This will divide the road into twenty-mile sections, which are surely long enough. With heavy traffic, or on stiff grades, it may be necessary to use 5,000 or 6,000 volts, but there should be no occasion for going above this. Both the centre and the side trolleys have advantages. At the present time we can not make either system standard. For high-speed service but few suspension links should be used, so as to give the greatest flexibility possible. As the troubles of transmission lines increase in proportion to the number of miles of wire, one line is better than two. It may be necessary to place an attendant at each substation. This may not require his entire time, but he should always be within call to throw switches or to cut in spare apparatus.

Mr. A. H. Babcock, of Oakland, Cal., described some of the difficulties encountered in that section in high-voltage transmission work. In the mountainous country very little trouble is met, and a comparatively low line resistance is satisfactory; but as the coast is approached, fogs occur, which condense on insulators and cause grounds. This trouble is partially overcome by the use of fog boxes. Mr. Babcock is of the opinion that porcelain is not the proper material for line work. While its insulating qualities are excellent, mechanically it is poor. He spoke of the clearance which is maintained rigidly on steam railroads. Electrical engineers should bear this in mind, as no trespass will be allowed. He said that, at the present time, the companies in California are carrying 60,000-volt lines through cities. No accident has happened as yet, though in one case a line

did break and fall on an asphalt pavement. He referred to the trouble which telephone systems may experience on account of the low frequencies now coming into use.

A communication from Mr. C. O. Mailloux, New York city, was read by Dr. Samuel Sheldon. This describes the former's recent inspection of European systems, dealing particularly with the Huber system now being developed by the Oerlikon Machine Works. A large number of excellent slides illustrating this system were shown.

Mr. Varney, in closing the discussion, described some tests which had been made to determine the amount of leakage taking place on a 3,000-volt system. In all cases it was found to be an exceedingly small quantity.

Professor Sever, referring to the point Mr. Babcock had made as regards railway clearance, said that the New York, New Haven & Hartford Railroad would not allow any wire to pass over its tracks at a less height than twenty-one feet. Professor Sever thought that high voltages are too dangerous to carry through towns, and should be carried around them.

The meeting then adjourned.

An interesting comparison of present methods of travel with that of a little over half a century ago is found in an article entitled "The National Road," by Philip S. Rush, in the *Four-Track News* for April. When the National road was nearly completed the panic of 1837 swept over the country, and the consequent political disturbances caused the abandonment of the highway, then barely half through Illinois. No work was done after 1841. Two years before, however, a line of stages and post routes had been started from Cumberland, Md., to Terra Haute, Ind., from where a tri-weekly service carried passengers and mail to Springfield, Ill. This marked the first regular overland travel from East to West. Passengers and mail fared alike as they jolted along in the cumbersome coaches, drawn by four strong western horses, and driven by men hardened to exposure in the bitterest winter and the hottest summer. Travel was confined principally to merchants and professional men, on account of the high rates. A passenger, and fifty pounds of baggage, was charged ten cents a mile. Clay and Lincoln, and many other great men of the country, traversed this pathway.

The Constitution of Matter.

Professor J. J. Thomson lectured on Friday, March 10, before the British Royal Institution on the modern electric theory of matter. The following report of the lecture is taken from *The Electrician*, London.

The theory of the atom now almost universally accepted supposes that a number of negative corpuscles are held balanced in orbital motion by the attraction of a positive nucleus to which, therefore, the corpuscles are satellites. The number of satellites determines the nature of the element, about 1,000 corpuscles, for instance, going to the making of an atom of hydrogen. Now the potential energy possessed by each corpuscle in an atom has been found by Professor Thomson to depend on the number of corpuscles present, and is thus different for different atoms; in fact, if a curve be drawn expressing as heights the potential energy per corpuscle and as horizontal distances the number of corpuscles present in an atom, this curve has crests and hollows. If number of corpuscles and atomic weight be taken as identical, a crest thus represents an atom which can exist for but a moment, while a hollow represents a stable element.

Thus we get a glimpse of the reason why in the evolution of the universe only a certain number of elements of very definite atomic weights remain in permanent existence. The reason is, in fact, analogous to that of the gathering of boulders in the hollows and not on the summits of a hill and dale country. The lecturer explained, however, that the calculation of the potential energy per corpuscle gives different numerical results on different assumptions as to the behavior of positive electricity when two atoms coalesce to form a new element. If positive electricity be supposed, for example, to behave as an incompressible fluid, then with increasing atomic complexity the potential energy per corpuscle on the whole increases, and thus the general tendency in atomic evolution will be toward smaller and smaller atoms. Further, if the generalization be permissible, the universe probably began (if the above assumption regarding positive electricity is correct) as a single vast atom which has in the course of the ages broken down to the state in which we now know it. Another new development announced by the lecturer lies in the introduction of the idea that in such a system as he imagines the atom, there is a number of directions along which the combined actions of the positive and negative charges give an electric field which possesses the peculiarity that close in an electric charge will be repelled, further out will be attracted. This theorem was effectively illustrated by a variation of that magnetic model of the atom used a year or more ago by Professor Thomson. In that model movable magnets are gathered into definite geometrical patterns, in spite of the mutual repulsions, by a central attracting pole. The central pole represents the positive nucleus, the attracted poles the negative satellites. The new variation of this experiment consisted in representing a certain atom by three like magnet poles placed at the corners of an equilateral triangle at whose centre were gathered the opposite poles. With this arrangement distant floating poles were repelled when nearer in, attracted when further out, and thus came to rest in perfectly definite positions. But all this happened only along certain lines of symmetry radiating from the atom. These directions round the atom are the valency bonds of the chemist, now for the first time materialized. Thus the electric atom brings into consideration two types of field force existing round it. There is the ordinary electric field which it creates when it becomes electrically charged through possessing a corpuscle or two too many or too few; and there are the valency attractions which promise stable combinations between atoms to form molecules. Pushing this idea further Professor Thomson showed that it gave to the atom precisely those properties Van't Hoff and Le Bel have demanded in their theory of the asymmetric carbon atom, which, developed out of a consideration of the rotation given by certain compounds to plane polarized light, plays now so large a part in stereochemistry.

Telephonic Detection of Wine Adulteration.

It is reported by Mr. Richard Guenther, United States consul at Frankfort, Germany, that M. Maneuvrier has devised a method for detecting the adulteration of wine with water or other liquids. Two glasses are filled, one with the wine to be tested, and the other with a like quantity of wine known to be pure. These are placed in an apparatus, apparently a modification of the Wheatstone bridge. Current is then passed through the two liquids, and a noise will be heard in the telephone if one sample of wine is impure. When this is the case, by moving an index until the noise disappears, the resistances in the two cups are equalized, and an indication of the quantity of extraneous matter in the wine is given.

Reviews of Current Engineering and Scientific Literature.

An Ampere-Meter for High-Potential Circuits.

A description is here given by Mr. H. C. Snook, of an instrument for measuring the current flow in the secondary of an induction coil. The particular application of the instrument is that in connection with the excitation of X-ray tubes. The current flowing in the secondary circuits of these coils is alternating, but unsymmetrical, and as it is desired that it shall flow in one direction only, it is customary to prevent a discharge passing through the tube while the primary current is flowing, and to allow only the discharge due to the break of the primary current to flow; hence, the instrument mentioned must be designed so as to average the value of a number of rapid, intermittent discharges having one direction. This is accomplished by using a suitable damping arrangement. The instrument itself is of the D'Arsonval type, and the discharge is passed through the movable coil. The arrangement is as follows: one terminal of the movable coil is connected to the core of the permanent magnet and to the case. This is done to avoid any great difference of potential between the parts of the instrument. In parallel with the movable coil is a non-inductive resistance and a small condenser. The function of the non-inductive resistance is to maintain a difference of potential between the terminals of the meter, proportional to the current flowing. The condenser is used to obtain a more uniform flow of current through the coil. The apparatus is useful in several ways. It enables different coils to be compared, and the condition of one coil to be determined, for the current flowing varies with the vacuum of the tube. A "soft" tube usually takes more current than a "hard" one. For a given tube, it has been found that the ammeter reading is closely proportional to the quantity of X-rays radiated; hence, the ampere-meter is useful as a means of regulating the dosage. —*Abstracted from the Journal of the Franklin Institute (Philadelphia), March.*

Parallel Running of Alternators Driven by Large Gas Engines.

During a recent trip through Germany and Belgium, Mr. E. K. Scott had an opportunity of inspecting a number of generating stations where alternators are driven by large gas engines. At these stations the engines varied from 500 to 1,500 horse-power. Nearly all of them were three-phase generators, and the engines were supplied with blast-furnace gases. All but one were single-crank engines, working with two impulses per revolution. There was no difficulty in running the three-phase generators in parallel at any of the plants. At the Oberhausen works there are two 1,200-horse-power Körting engines, driving Siemens alternators, and two 600-horse-power Körting engines, driving Allgemeine Elektricitäts Gesellschaft alternators. These machines run perfectly in parallel, and are easily synchronized with the switchboard, although the attendant can not see all of them when synchronizing. It is believed that, with one single-crank large gas engine of good construction, in which there are two impulses on the crank per revolution, and where sufficient flywheel weight is allowed, either in the generator wheel, or, better, in the generator wheel plus a flywheel, parallel running is easy. The higher the speed, the better is the paralleling. In the operation of these plants the only thing that causes trouble is the water used for cleaning the gas. This is sometimes carried over into the cylinder, and interferes with the operation of the sparking plugs. The piston rods and pistons are cooled by water, as also are the exhaust valves. A spray of water plays into the exhaust pipe, and thus prevents noise and firing back. The engines are started by means of compressed air without any difficulty. They do not require many attendants, and the work is practically identical with that of running a slow-speed steam engine.—*Abstracted from the Electrical Review (London), March* 10.

The Engine Equipment of Motor Omnibuses.

A description is here given of the types of motor omnibuses which have been developed for city use. They vary considerably in design, some being double-deckers, some having but a single deck. Some of them are intended to be operated by one man, others require two. The mechanical equipments vary considerably. They are all either steam or gasoline machines. The engines vary in output from twenty to thirty horse-power. For instance, the machine manufactured by the Brush Electrical Engineering Company contains a twenty-horse-power gasoline engine, and will make speeds varying from four and one-half to fourteen miles per hour. The Clarkson steam omnibus is equipped with a thirty-two-horse-power steam engine. This is a double-decked omnibus, and carries thirty-two passengers. The same company makes a thirty-two-horse-power country omnibus with seats for eighteen passengers, and space for 1,500 pounds of baggage. This machine is steam-heated. The maker estimates that the cost of operating the latter bus is less than seven cents per bus-mile. The Maudslay Motor Company is building a small bus for the Great Western Railway Company. This carries from twelve to fourteen passengers, at speeds up to twelve miles an hour. It is driven by a fourteen-brake-horse-power, two-cylinder gasoline engine. Another bus, built for the Great Western company by the Milnes-Daimler Company, is driven by a four-cylinder, twenty-four-horse-power engine, and makes speeds varying from two and one-half to twelve miles an hour. This bus seats thirty-four passengers. The Motor Car Emporium builds a single-deck bus seating sixteen passengers, which is driven by a four-cylinder, twenty-horse-power engine, and a double-deck bus for thirty passengers, which is driven by a four-cylinder, twenty-four-horse-power engine. The average consumption of these buses is one gallon of gasoline for eleven miles. They carry enough fuel to run them 100 miles. The bus manufactured by John I. Thornycroft & Company is a double-decker, and seats thirty-four passengers. It is driven by a twenty-four-horse-power gasoline engine, at speeds varying from three to twelve miles an hour. A number of other buses are described, but they all have about the same seating capacity, and are equipped with engines having about the same rating.—*Abstracted from the Tramway and Railway World (London), March* 9.

The Secondary Roentgen Radiation.

It has been found by Dr. C. G. Barkla, while the intensity of secondary radiation from light substances varies considerably in different directions, owing to the partial polarization of the primary radiation, the amount of this variation diminishes with an increase in the atomic weight of the radiator, and ultimately is inappreci-

able. The radiations from air, carbon, paper, aluminum and sulphur vary in intensity in different directions by a considerable amount. From calcium the radiation is much less, while from iron, copper, zinc and lead it is inappreciable. This must be connected with the fact that the radiation from light substances differs in character only from the primary, while the heavier substances emit radiations differing more from the primary producing them. The radiation from the heavier metals was found not to consist of an easily absorbed radiation superposed on a radiation such as proceeds from light substances, and of intensity given by the law found for them from light substances, but is a completely transformed radiation. This is strong evidence that the freedom of motion of the electrons, which permits what may be called a simple scattering in substances of lower atomic weight, is not interfered with in the heavier atoms, for we find from them a more absorbable radiation in place of—not simply superposed on—a more purely scattered radiation. The radiation from compounds appears to be merely a mixture of the radiations which proceed from the separate elements of the compound. Atomic weight, not molecular weight or density, seems to govern the character of the radiation produced by a given primary. These results may be accounted for by considering the electrons constituting the atoms as the radiators. In light atoms the electrons are far enough apart and have sufficient freedom to move almost independently of one another under the influence of the primary pulses; consequently, to emit a secondary radiation similar to the primary, but the intensity of which depends on the direction of propagation with regard to that of electric displacement in the primary beam. In heavier atoms considerable inter-electronic forces are probably brought into play by small displacements, and the resultant acceleration of motion of an electron is then not in the direction of electric displacement of the primary beam, and evidence of polarization of that beam vanishes. Also, there ceases to be a simple connection between the time for which the electron is accelerated and that of passing of the primary pulse.—*Abstracted from Nature (London), March* 9.

Steam Turbine Tests at the Neepsend, England, Electric Station.

Last year the new turbo-generators were put into service at the Neepsend electric station. These are two-phase machines, there being two of them. They are of the revolving-armature type, and were specified to give an output of 1,500 kilowatts at from 2,000 to 2,200 volts, and fifty cycles per second, on an inductive load, having a power-factor of 0.85. An overload capacity of ten per cent for one hour with a steam pressure of 190 pounds at the stop valve, and a superheat of 100 degrees Fahrenheit at the same point, was called for. The temperature of the circulating water was to be from sixty to eighty degrees Fahrenheit. The speed was 1,500 revolutions per minute. The steam consumption in pounds per kilowatt-hour was to conform to the following figures: with circulating water at sixty degrees Fahrenheit, 18.4 at full load; 21.2 at half load. At eighty degrees Fahrenheit it was to be 20.2 at full load, and 23.4 at half load. These figures were not to include the power required for the air and circulating pumps, as these are motor-driven from the station bus-bars. The exciters are direct-coupled to the turbine shafts. The turbines were tested at the shops of the Sheffield corporation before erection, and showed a steam consumption of 24.02 pounds per kilowatt-hour with a load of 534 kilowatts, the superheat being 119 degrees Fahrenheit, and the steam pressure being 137 pounds. The vacuum was twenty-six inches. With a load of 1,029 kilowatts, the superheat being 142 degrees, the pressure above atmosphere 115.6 pounds, and the vacuum 28.18 inches, the steam consumption was 20.70. With a load of 1,584 kilowatts and 128.5 pounds steam pressure, 125.3 degrees of superheat, and 26.76 inches of vacuum, the steam consumption was 17.61 pounds per kilowatt-hour. At this load the average full-load excitation was one-half of one per cent. After the machines had been erected—that is, in July, 1904—they were tested, with the following results: with a load of 1,596.9 kilowatts, the steam pressure being 179.8 pounds, the superheat 92.7 degrees Fahrenheit, and the vacuum twenty-seven inches, the steam consumption was 18.9 pounds per kilowatt-hour. When the load was raised to 1,611.4 kilowatts, with a steam pressure of 193.7 pounds and a superheat of 100 degrees, the vacuum being 27.4 inches, the consumption of steam was 18.3 pounds per kilowatt-hour. After the machines had been in operation for five months, an average was taken of ten weeks, from November 20 to January 22, with the following results: steam pressure, 190 pounds; superheat, 100 degrees Fahrenheit; vacuum, twenty-seven inches; load, 979 kilowatts; steam consumption per hour, 22.41 pounds per kilowatt. The total operating cost of the Neepsend station averaged, during ten weeks, 0.42 cent per kilowatt-hour—*Abstracted from the Electrician (London), March* 10.

Facilitating Export and Import Business with Austria.

Mr. Urbain J. Sidons, American consul at Prague, Bohemia, Austria, announces a system whereby American exporters and importers may facilitate an exchange of commodities between America and the kingdom of Bohemia. A series of filing cards will be forwarded, upon request, to manufacturers. These are to be returned to the consul, bearing the following commercial data: name of firm, street, city and cable address, codes used, export discounts and prices, languages of correspondence, reference or commercial rating, nature of exports and imports, list of foreign branches and agents. This information is to be accompanied with catalogues, prices current, discount sheets, photographs and small samples—in fact, with all the commercial literature necessary to secure proper recognition of the company's material. The idea of this system is to place before the foreign buyer full data concerning any American manufacturer, making it feasible to send orders by cable in the most direct and economical manner.

Railway and Telegraph Rates in Panama.

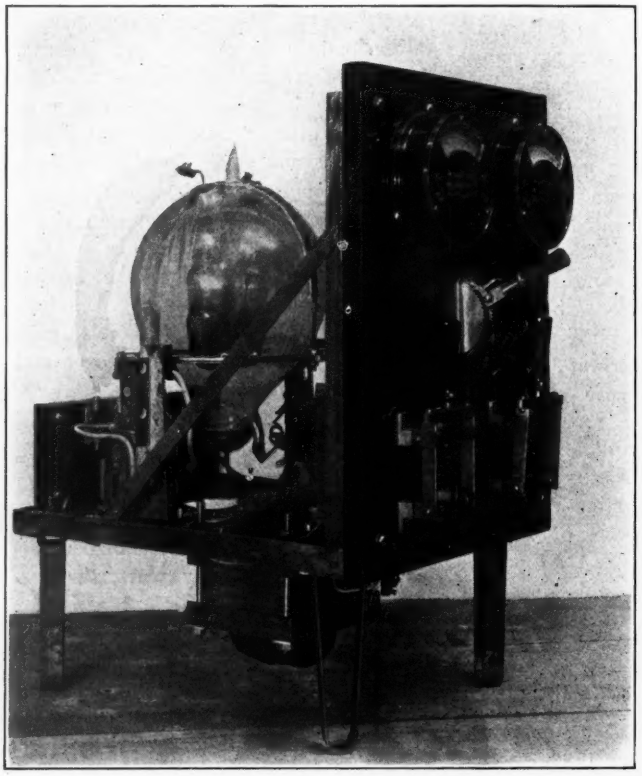
United States Consul-General H. A. Gudger, at Panama City, Panama, announces that, for many years, the passenger, telegraph and freight rates for service across the Isthmus of Panama have been very high. It is generally understood, however, that during the present month, the rates will be greatly reduced. In anticipation of this the company has issued a tariff covering the subjects under consideration, in which a considerable reduction is made in charges. The passenger rates across the isthmus have been four dollars gold for first class, and six dollars currency for second class. By the new tariff, a first-class passage will cost $2.40 gold, while the second-class rate will be $2.85 silver. These rates do not cover the charge for baggage, that remaining as heretofore at three cents gold per pound. The old rate for telegrams was one dollar gold for ten words, and ten cents for each extra word. The new rate is twenty-five cents gold for ten words, and two cents for each extra word.

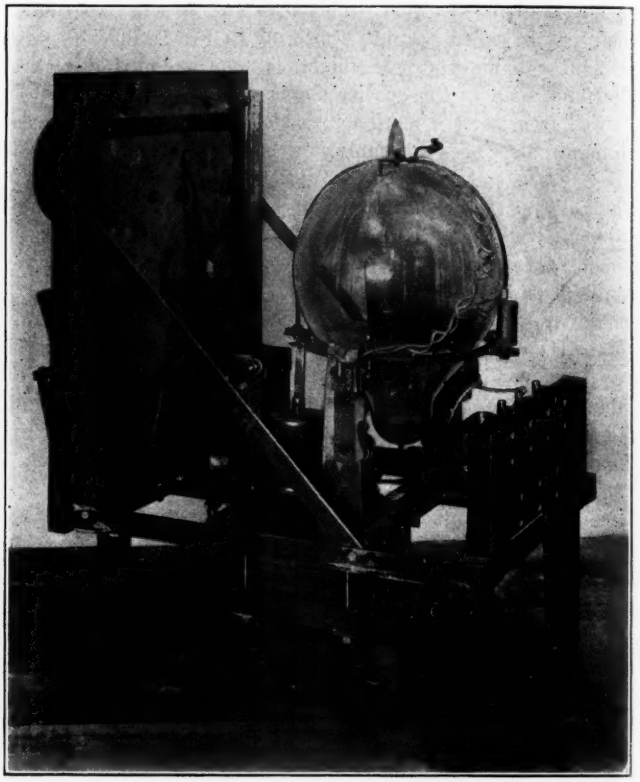
INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

The Cooper Hewitt Mercury Vapor Converter.

When it was announced, something over two years ago, that a peculiar property of mercury vapor made possible the construction of an electric valve for converting alternating current into direct current, much interest was aroused. The usual method of converting alternating current into direct involves the use of rotating apparatus, such as the rotary converter or a motor-generator. If such a device, involving no moving parts, could be produced, it would form a very desirable addition to electrical appliances. This has now been done, and the principle discovered by Mr. Peter Cooper Hewitt is being applied in a commercial device developed by the Cooper Hewitt Electric Company, 220 West Twenty-ninth street, New York city. This device is illustrated in the accompanying photographs.





FRONT AND REAR VIEWS MERCURY VAPOR CONVERTER.

The Cooper Hewitt mercury vapor converter may be used for converting alternating current into direct current for any purpose, but for different uses some changes in the arrangements of the circuits are preferable. The apparatus shown in the illustrations is designed for delivering thirty amperes on the direct-current side, at from 110 to 120 volts. The alternating supply may be of any voltage or any frequency, though the particular frequency for which this apparatus was designed is sixty cycles per second. This is a single-phase converter, though it may be used on any phase of a polyphase system. It is adapted especially for charging storage batteries and for running direct-current motors and mercury vapor lamps. It is also suitable for electrolytic work, and will operate well on a pure resistance load such as incandescent lamps. The outfit, as supplied, is complete, ready for installation in any garage where only an alternating current is available. It operates without any attention after once being started. There are no movable parts except the automatic starter, but this only comes into play when it is necessary to start the converter. The outfit is automatic. To start it it is only necessary to close the alternating-current and the direct-current switches. Should the converter go out for any reason, it will start itself again, provided the proper alternating-current voltage is available. The apparatus may therefore be left running without any attendance, with the assurance that, should it be put out of service for any momentary failure of the alternating-current supply, it will start itself again upon the return of the voltage. During these interruptions there is no possibility of the batteries discharging back through the converter. If desired, the opening of a switch will render the converter non-automatic. The current may be varied while the converter is in operation throughout the full range of the device. This is accomplished by means of a variable inductance in the alternating-current side. The variation of this particular converter is between six and thirty amperes, though a wider range could be secured with some sacrifice in efficiency. The apparatus is stable. It will operate throughout any reasonable range of voltage.

The device, as shown in the illustration, consists of a glass bulb about nine inches in diameter, having at the bottom a mercury electrode, and projecting through the upper part two large electrodes, the terminals of which are solid. This is mounted on a rocking cradle, which is supported upon a stand. The entire apparatus occupies a space about

fifteen inches wide, twenty inches long, and twenty inches deep. If desired, it may be mounted on brackets, for attaching to the wall. To the front of the stand is attached the controlling switchboard, and the device is protected at the top and back by a sheet of iron, and on the sides by wire gauze, which allows for ventilation. On the stand are mounted also the regulating inductance, the sustaining coil and the automatic starter. Upon the switchboard are a voltmeter and ammeter, connected in the direct-current circuit. Below are the alternating and direct-current switches, and the handle for regulating the current. This handle shifts the core of an inductance coil which is placed in the alternating-current circuit, and in this way varies the voltage of the supply. The voltage of the direct-current side will vary with the alternating voltage, and thus the current is regulated to the desired intensity.

Without some auxiliary device, a single-phase, alternating-current, when rectified, would form a pulsating current varying through a considerable range. If the current be allowed to die out when the alternating-current voltage is less than a certain low value, the converter would go out, and would require restarting. To avoid this, a sustaining coil is placed in the direct-current side. This is merely a large inductance coil, designed to carry the full load of thirty amperes. Its action is such as to maintain the direct current very nearly constant, and this prevents the converter from going out of operation. However, should the alternating-current voltage fail, and the apparatus go out of operation, the automatic starter will at once restart it.

The device is started by tilting, in a manner analogous to one of the types of Cooper Hewitt mercury vapor lamp. When the alternating-current switch is thrown, a small electromagnet attached to the rocking cradle tilts the converter bulb through an angle, and thus starts an arc between an auxiliary electrode and the mercury electrode. As soon as this is started, the current will begin to flow through the direct-current circuit, if the switch be closed, and the bulb will return to its normal position.

In the apparatus designed for lower alternating-current voltages—say, not above 450—an autotransformer is used for obtaining the proper alternating-current potential. Where higher voltages are used a transformer is better, since this separates the primary and secondary windings.

The efficiency of this apparatus is high for its output. The apparatus is protected by fuses, and may be left in operation over night, if desired, provided there is no risk of overcharging the batteries. It is noiseless in its operation, and as skilled attendance is not required to operate it, it is particularly suitable for garages. All that is necessary to start or stop the apparatus is to close or open the switches. A number of these outfits have been ordered, and are in service.

Single-Phase Motors for Electric Hoist and Traveling Crane Service.

The Wagner Electric Manufacturing Company, St. Louis, Mo., is now prepared to furnish sixty-cycle, single-phase, alternating-current motors for elevator, hoist and traveling crane service. These motors are of the induction type, and possess all the desirable characteristics of the best types of direct-current motors for work of the same character. This single-phase motor possesses in one winding the starting characteristics of the series type of direct-current motor, and the running characteristics of the shunt type of direct-current motor.

Elevator service imposes a heavy static and inertia load at the instant of starting, this load, with the best types of elevators, being about fifty per cent in excess of full running load. The driving motor must therefore develop at the first instant of starting a torque not less than fifty per cent in excess of its full running torque. With the single-phase motor now offered by the company, starting current under full load conditions not exceeding fifty per cent in excess of the full load running current is used. This excess of starting current disappears quickly, since the nature of the service is such as to require an excess of torque momentarily, the first couple of turns of the rope drive eliminating the static and inertia elements. The excess energy demand from the circuit to provide the necessary starting torque is limited to one or two seconds. With the proper controlling mechanism, the starting current will fall to full load current within two seconds after the current is applied to the motor, and will thereafter be practically full load current up to full speed.

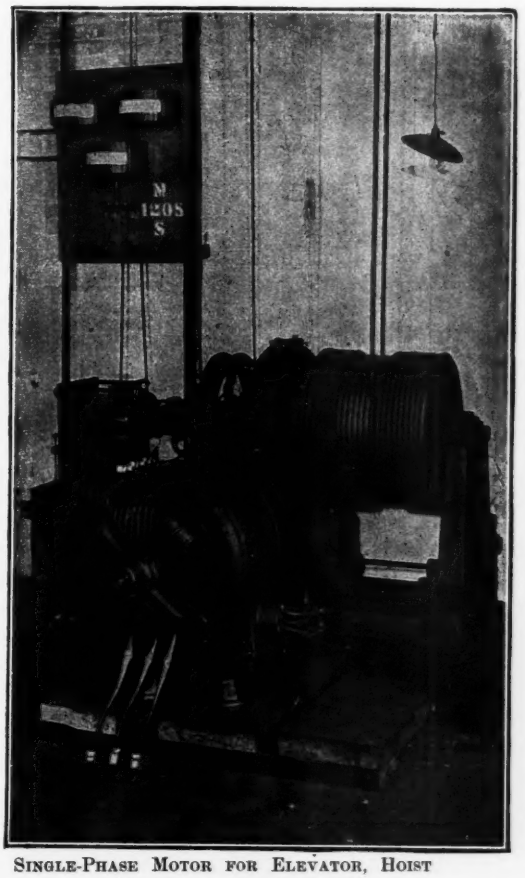
The inherent characteristics of this single-phase motor are such that this load is not abruptly applied to the circuit, but may, with the proper controlling devices, be applied with sufficient gradation to make it possible to serve an elevator motor from a lighting transformer without affecting the lights to a noticeable extent.

The power-factor, as with all types of induction motor, is less than unity. By proper design, the company has been able to secure a power-factor of from eighty per cent to eighty-five per cent, both in starting and at running speed.

Elevator service requires an acceleration from rest to full speed of from four to ten seconds, depending upon the frequency of stops and upon the kind of duty to be performed. The inherent characteristics of this single-phase motor are such that the acceleration can be made anything desired.

Conditions frequently arise in elevator service under which it is desirable to employ the braking power of the motor running as a generator on the down trips. This single-phase motor acts as an induction generator when the armature is rotating at a speed in excess of synchronism.

The company is prepared to furnish this type of construction in all of the usual standard sizes up to and including twenty-five horse-power. Immediate delivery can be made on the ten-horse-power



SINGLE-PHASE MOTOR FOR ELEVATOR, HOIST AND TRAVELING CRANE SERVICE.

size. This size at present is required for probably sixty per cent of elevator service.

At the present time the company has developed controllers for rope control only. It is the expectation, however, to develop other types of control in the near future.

This type of motor is capable of a speed control through fiftv per cent of the speed range. Installations requiring service of this sort will be undertaken upon receipt of specifications. This characteristic of the motor will be especially useful with ventilating fans and certain kinds of machine tools.

The Case Controller.

The Case Manufacturing Company, Columbus, Ohio, is meeting with considerable success in the application of its "F" and "FS" type controllers. The

FIG. 1.—PARTS OF KNIFE CONTACTS.

Case Manufacturing Company, in its work of engineering and building cranes and power-transmission appliances, real-

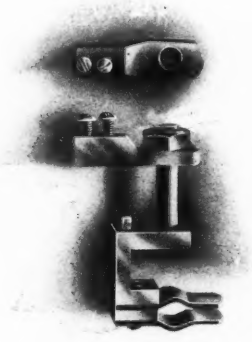


FIG. 2.—KNIFE CONTACT ASSEMBLED.

ized the requirements of control for electric motors, as applied to cranes and steel mill work. The design of this controller is radical in many ways. The contacts

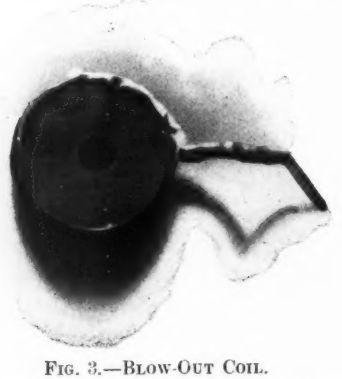


FIG. 3.—BLOW-OUT COIL.

are of large area, and made of hammered copper and phosphor-bronze. The principles involved are similar to the old knife switch, with a hard copper disc passing between the blades in a constant shearing motion. The disc is always in contact with at least two of the contact blades, minimizing sparking between steps. The first step is provided with a quick-break device, making it impossible to prolong the arc by shutting the controller off slowly. The reversing circuit is opened

FIG. 4.—QUICK-BREAK CONTACT.

only after the lines have become dead through the action of the quick-break device.

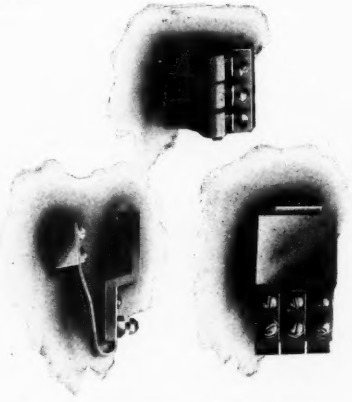


FIG. 5.—REVERSING SWITCH FINGERS.

Fig. 1 shows the various parts of the knife contacts, Fig. 2 showing the knife contacts assembled. These phosphor-bronze knife-blade contacts are easy to replace, requiring the removal of two machine screws to replace each set. The contacts are mounted on a slate slab, and connection to the resistance is accomplished by means of an ordinary brass terminal. The roller knife blade is made

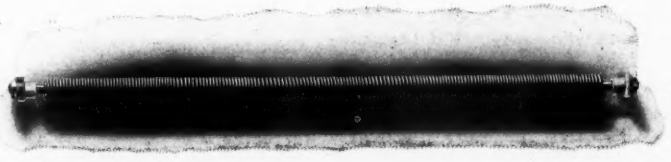


FIG. 6.—RESISTANCE COILS.

of a hammered copper disc, rotating in a strong magnetic field, the arc on the break being at direct angles to the magnetic lines of force across an air-gap of a half inch. Fig. 3 shows the blow-out coil. These coils are wound on a form and dipped in an insulating varnish, thoroughly baked, then taped with friction tape and painted with an insulating compound.

The contacts for reversing the motor

FIG. 7.—INSULATING BUSHING, JUMPER AND COILS' TERMINAL.

are of cast brass of large surface, and machined true. The fingers for the reversing contacts are made of hammered

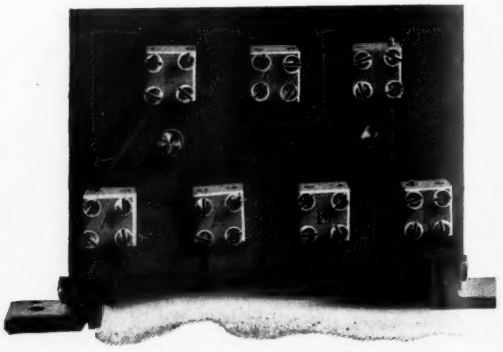


FIG. 8.—TERMINAL BOARD.

copper, and are of large dimensions. They are carried on phosphor-bronze springs of large sectional area, and in the large sizes, the "pigtail" connector is used to relieve them of the load. They are provided with an adjustment of tension which is easy to operate. They do not perform the function of a switch at any time, as the circuit is always open before they pass off the contacts. Fig. 4 shows the quick-break contact, and Fig. 5 the reversing switch fingers.

Fig. 6 shows the resistance coil. The

resistance consists of German steel and iron wire coils on asbestos knobs mounted on formed tin stiffeners. These are supported at either end on a porcelain bushing through a cast-iron channel, the ends of the coil being screwed on to a malleable iron terminal. The cross-connections are

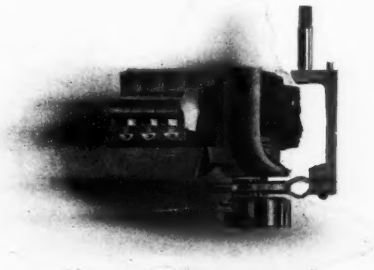


FIG. 9.—CONTROLLER LEVER ASSEMBLED.

accomplished by means of copper ribbon jumpers placed at the top and bottom of the controller, and in order to replace a coil, all that is necessary is to remove two nuts on either end, and the coil comes out without disturbing any other coils or any connections.

The wiring from the resistance coils to the controller is made with underwriters' wire, and asbestos and mica are used liberally for insulation. The terminals are all brought out to a slate terminal board at the base of the controller. All that is necessary to install the con-

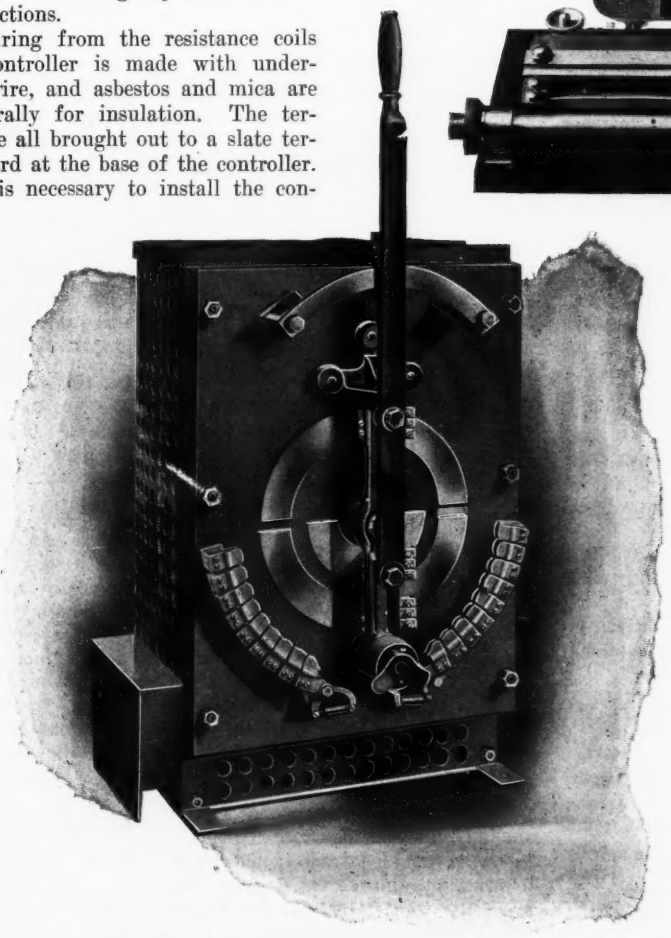


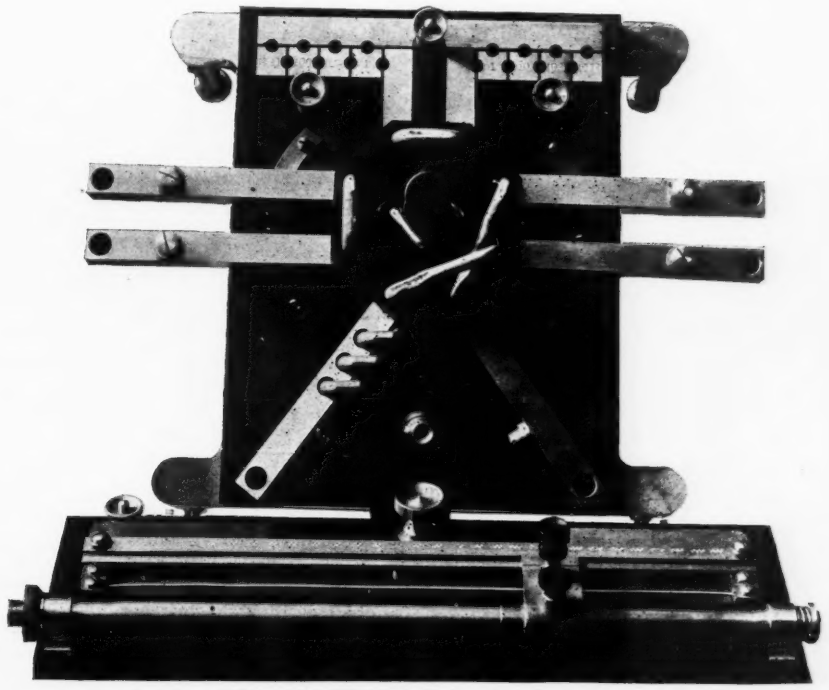
FIG. 10.—THE CASE TYPE F CONTROLLER.

troller is to run one wire from each line, two from the fields, and two from the armature circuit to the terminal board. Fig. 7 shows the insulating bushing, jumper and coil terminal. Fig. 8 shows the terminal board.

Where especially close regulation is required, such as handling cores and cope on a crane in foundry work, an auxiliary lever is placed on the controller, by means of which is secured double the number of variations of speed. The company states that it can guarantee the control of any series motor from ten per cent of its rated speed to the maximum speed, under any load up to its rated capacity. Fig. 9 shows the controller lever assembled. Fig. 10 shows the type "F" controller.

The Carey-Foster Bridge and Commutator.

The accompanying illustration shows the form of Carey-Foster bridge and commutator made by Queen & Company, Philadelphia, Pa. This apparatus possesses several features of advantage. The bridge and commutator is made in two sections. The section containing the commutator is complete in itself, and can be used with any slide and wire attachments.



CAREY-FOSTER BRIDGE AND COMMUTATOR.

The conductors of heavy copper rod are mounted on a hard-rubber base, around the outside edge of which is a light ribbed brass casting. In each corner of this an adjustable leg is mounted, providing for various styles of resistance standards used in comparisons.

To join up any pair of ratio coils, it is only necessary to insert two plugs in the properly numbered holes to have them connected in circuit. The layout is such that the ratio coils can be joined in series, if desired, thus obtaining an appropriate value for all of the ranges of resistance which may be compared with it.

By reason of the adjustability in height, the Reichsanstalt pattern can be used, with or without the cooling bath.

Three separate shunts are provided for the bridge wire, and any single shunt or combination of shunts can be used. The bridge wire is about 300 millimetres long, with a vernier reading to one-twentieth of a millimetre. The contact device is of Queen & Company construction, which does not allow the bridge wire to be dented through undue pressure upon the key.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

BONDS FOR NEW YORK CITY LIGHTING PLANT APPROVED—Mayor McClellan, of New York city, approved, on March 21, a $600,000 bond issue for money for the purchase of a site for the proposed municipal lighting plant.

ROCHESTER & EASTERN ELECTRIC RAILWAY SOLD—It is announced that a deal has been closed whereby the property of the Rochester & Eastern Railway, in New York, has passed to George L. Lewis, of Buffalo, N. Y. It is said that the price paid for the property was something over $2,000,000. The road runs from Rochester east, through a rich and populous country, to Geneva, N. Y.

NEW TELEPHONE RATES IN NEW YORK CITY—The New York Telephone Company has announced a revision of rates for telephone service, to go into effect on May 1. For 600 messages the rate has been reduced from $75 to $60; for 1,200 messages, it has been reduced from $111 to $87; for 1,800 messages, from $141 to $111; for 2,400 messages, from $165 to $135; for 3,000 messages, from $183 to $159; for 3,600 messages, from $201 to $177; for 4,500 messages, from $228 to $204.

WIRELESS REGULATIONS—The international conference called by the German government to consider questions relating to the regulation of wireless telegraphy and to the granting of international concessions, which was to have been held on April 4, has been postponed to an indefinite date in the near future. The German government has requested that, pending the meeting of the conference, no action be taken by other governments that might be in conflict with the possible action of the conference.

NEW YORK CENTRAL BUYS POWER—It has been announced that the Hudson River Water Power Company has contracted to furnish the New York Central & Hudson River Railroad with 25,000 electrical horse-power yearly for twenty-five years. The minimum charge will be $125,000 per year. Power will be delivered from Speir's Falls and Scoharie Falls, together with current from a temporary steam plant to be erected in Utica, N. Y. The energy will be used in the development of various trolley interests which the railroad company is taking up.

MANHATTAN ELEVATED TO BUILD ADDITIONAL ELEVATED TRACKS—The directors of the Manhattan Elevated Railway Company have voted to build two additional elevated railroad tracks in conjunction with the Second Avenue elevated railroad. The two new tracks will be used for express trains, and at the downtown end will run into the subway, so as to afford a new express route from the Battery to Harlem. The present tracks on Second avenue are along the sides of the thoroughfare, so that there is a wide intervening space between the up and downtown tracks. This space will be utilized for the proposed additional tracks.

MEXICAN ELECTRIC RAILROAD—The Dwight-Furness Company, of Guanajuato, Mexico, which purposes constructing a standard-gauge railroad from Guanajuato to Irapuato, Mexico, with an extension to Salamanca, to connect with the National Railroad, is endeavoring to secure entrance for the road to Guanajuato. It is stated that an offer of $200,000 has been made to the Guanajuato Street Railroad Company for its lines and concessions in the city of Guanajuato, and for its right of way from Guanajuato to Marfil. Surveyors are now in the field laying out the route of the electric line, and it is expected that active construction work will be commenced within a few months.

ELECTRIC LIGHTING.

TEMPLE, TEX.—Thomas Fairweather, of Belton, has purchased the holdings of J .T. Smither in the Temple Water Works Company and the Temple Electric Light Company.

ELGIN, ILL.—The mayor of Elgin has signed the electric light ordinance providing for the turning over of the city plant to the Elgin, Aurora & Southern Traction Company, for a period of ten years.

BALTIMORE, MD.—The new Consolidated Electric Light and Gas Company, of Baltimore, has made a bid of $57.49 per lamp for lighting Baltimore. The city is now paying $99.92 per lamp.

COVINGTON, GA.—Arrangements are being made by the Covington city council for the reestablishment of the city electric lighting plant, which was destroyed on December 26 by the explosion of a boiler.

SANFORD, ME.—The Sanford Light and Water Company has let the contract for its proposed reservoir, on Hansons ridge, to L. N. Farnham. The reservoir will have a capacity of 1,000,000 gallons.

WAYNESBURG, OHIO—The Sandy Valley Heat, Light and Power Company has been granted a fifty-year franchise by the town of Waynesburg, on condition that plant is built and in operation in two years.

SHELBYVILLE, ILL.—A contract for the sale of the plant of the Charleston Gas and Electric Company has been closed by Ning Eley, of Chicago, representing a company of capitalists headed by Senator Shumway, of Taylorville.

ONEIDA, N. Y.—At a meeting of the board of public works the mayor and city clerk of Oneida were authorized to enter into a contract with the Madison County Gas and Electric Company for lighting the city for a term of two years. The contract calls for about $7,000 per year.

PUEBLO, COL.—The trustees of the north side waterworks of Pueblo have decided to install an electric light plant in the pumping station. It will have a capacity of 100 incandescent lamps. The cost of operating will be light because steam can be drawn from the present boiler equipment. The superintendent, Wilson, has been authorized to begin the installation at once.

TRENTON, N. J.—An agreement of merger between the Carteret Electric Light and Power Company and the Middlesex Lighting Company has been filed. The name of the consolidation is to be the Middlesex Electric Light and Power Company. The directors are Thomas M. McCarter, Newark; Albert B. Carlton, Elizabeth; Charles A. Sternberg, East Orange; Thomas C. Burr, Newark; Frederick Evans, New York city. Mr. McCarter is president of the new concern. The capital stock is $200,000.

CANAAN, CT.—The Berkshire Power Company has concluded a deal for the purchase of the Sharon Electric Light and Power Company, of Sharon. The Berkshire company is erecting a large power plant on the Housatonic river, and power from this station will ultimately be used to operate the Sharon business. Work on the dam is being pushed as rapidly as possible. The three waste gates at the west end have been completed, and one section of the dam is now being constructed on the east side of the river.

NIAGARA FALLS, N. Y.—Two 500-kilowatt generators in the De Ceu Falls power station of the Hamilton Cataract Power, Light and Traction Company, of Canada, have recently been started. Power is supplied from the Welland canal feeders, tapped about fourteen miles above the station. The power is transmitted thirty-five miles to Hamilton, at a pressure of 20,000 volts at present, which pressure is ultimately to be increased to 40,000 volts. A reserve steam-driven station at Hamilton contains two 1,000-kilowatt units. The power is used for lighting, traction and manufacturing purposes. At the annual meeting the following officers and directors were elected: president, the Hon. J. M. Gibson; vice-president, James Dixon; treasurer, J. R. Moodie; secretary and general manager, W. C. Hawkins. Directors—John Dickenson, J. W. Sutherland, J. A. Kammerer.

TELEPHONE AND TELEGRAPH.

MILFORD, IOWA—Milford has granted a franchise to the Midland Telephone Company.

LITTLE ROCK, ARK.—Poles are being erected and wires strung for a new exchange at Atkins.

CORVALLIS, ORE.—The Independent Telephone Company has purchased the Alsea telephone line.

MISHAWAKA, IND.—The Central Union Telephone Company has been granted a franchise in River Park.

WILLARD, UTAH—The Willard city council has granted a franchise to the Independent Telephone Company.

GLASSBORO, N. J.—The Rural Telephone Company has obtained right of way through Glassboro and Clayton.

MONTREAL, QUEBEC—The Bell Telephone Company has decided on the erection of a large branch exchange building.

CAMDEN, TENN.—A new telephone line will be built from Cooley's Landing, to a point on the Tennessee river, to Camden.

ANGOLA, N. Y.—The Hanover Telephone Company is building a new line from Brant to North Collins, to tap the Frontier system.

GARDNER, MASS.—The New England Telephone and Telegraph Company is to establish a telephone exchange in Hubbardston.

RENSSELAER, N. Y.—The Hudson River Telephone Company has purchased a site on which it will shortly erect a new exchange.

NEWARK, N. J.—The Chester Telephone Company will extend its line to German Valley, Middle Valley, Vernoy and Califon this spring.

COSHOCTON, OHIO—The sum of $35,000 is to be expended on the Coshocton exchange of the Bell Telephone Company this summer.

LYNCH STATION, VA.—The Carion Telephone Company, organized by Walter Fauntleroy and W. S. Frazier, is extending its line to Leesville.

WHEELING, W. VA.—An ordinance permitting the Pittsburg & Allegheny Telephone Company to build its lines in Canonsburg, Pa., has been signed.

CLINTON, N. J.—The Merchants and Farmers' Telephone Company is arranging to extend its line from Clinton to Glen Gardner, Junction and Asbury.

VAN ETTEN, N. Y.—The Nanticoke Valley, the Newark Valley and the Foster Valley telephone companies have united with the York State Telephone Company.

FINDLAY, OHIO—A telephone extension will be made from the Benton Ridge Mutual central office, following the Benton Ridge road into Findlay corporation limits.

SALT LAKE CITY, UTAH—The Rocky Mountain Bell Telephone Company is planning some important improvements in Bingham, owing to the rapid increase in business.

BIRMINGHAM, ALA.—The People's Home Telephone Company has secured a franchise to extend its lines to Woodlawn, a suburb of Birmingham, with 5,000 population.

BLOOMFIELD, IOWA—The Mid-Western Electric Company, of Cedar Rapids, has bought the Davis County telephone system, and will make make extensive improvements.

REDDING, CAL.—The Sunset Telephone Company has purchased the line of the Trinity Copper Company between Redding and Kennett, and will use it for public service.

WHEELING, W. VA.—The farmers living between St. Clairsville and Warnock have organized and will install a telephone system. There will be about thirty-five telephones on the line.

BIRDSBORO, PA.—The Conestoga Telephone Company will extend its lines into Union, following the Schuylkill road, and branching out to connect with patrons adjacent thereto.

HOUGHTON, MICH.—The Bell Telephone Company has arranged to extend its line from Nestoria west along the south shore, making short connections between Duluth, Marquette and the copper country.

TOLEDO, OHIO—The farmers about Muntanna are erecting a mutual telephone line. Those residing near Wisterman have organized a mutual telephone company also, with H. D. Taylor as president.

YOUNG HICKORY, N. Y.—The extension of the farmers' mutual telephone line to connect with the line of E. H. Austin, Jr., has been completed. This will give connection with Troupsburg and points east.

ROCKFORD, ILL.—Stockholders of the Winnebago County Telephone Company at a recent meeting voted to borrow $15,000 to complete the work of construction. W. F. Atley, of Durand, was elected a director.

BAY CITY, MICH.—District Manager Saunders, of the Michigan State and the Northeastern Telegraph and Telephone companies, announces the completion of the improvements in the telephone service in the Tawases.

STAMFORD, CT.—Contracts are soon to be let by the Southern New England Telephone Company for the work of laying conduits between Stamford and Bridgeport, preliminary to putting the toll-line wires underground.

SEDALIA, MO.—The merchants and farmers at Houstonia have formed a local telephone company and will put in an exchange. The officers are: M. P. Tuck, president; C. T. McConnell, secretary; Glen Robertson, treasurer.

MILTON, KY.—At a meeting of the citizens of Trimble County it was decided to form an independent telephone company, to connect Bedford and Milton and other points in Kentucky. The capital of the concern will be $15,000.

WEST POINT, VA.—The West Point town council has granted a franchise to the Southern Bell Telephone Company, of Richmond, for the use of the streets in erecting and operating a local and long-distance telephone system.

LYNCHBURG, VA.—All of the formalities concerning the granting of the telephone franchise to the Southern Bell Telephone Company for the right to construct and operate a modern telephone system in Lynchburg have been completed.

CORNING, N. Y.—The Campbell & East Campbell Telephone Company will build a line connecting Campbell and East Campbell. This line will exchange service with the Campbell & Risingville Telephone Company, and also with the Inter-Ocean company.

GUTHRIE, OKLA.—The Waynoka Telephone Company, to be located in Woods and Woodward counties, has been organized. J. A. Green, J. F. Scraman, G. P. Chestnut, R. A. Hendrie, E. P. Clapper and D. P. McNally, all of Waynoka, Okla., are the incorporators.

ST. LOUIS, MO.—At the annual meeting of the Laddonia, Rush Hill & Mexico Telephone Company, D. L. Rodgers was elected president to succeed J. N. Rosser. The other officers elected are: E. A. Fentz, secretary, and John Fry, J. W. Rosser and Earl Cunningham, directors.

PORT BYRON, N. Y.—The Port Byron Telephone Company has let the contract for constructing upward of fifty miles of new lines to Claude P. Taylor & Company, of Penn Yan. All the material for the work has been purchased, and work will begin as soon as the material arrives.

WATERVILLE, N. Y.—At a meeting of the directors of the Waterville Telephone Company the following officers were chosen: president, I. D. Brainard; vice-president, S. W. Goodman; secretary, H. M. King; treasurer and general manager, Parks A. Terry. The company is capitalized at $25,000.

MUSCATINE, IOWA—Six new telephone lines will be constructed north of Muscatine during the next two months. The lines will radiate from Flat Iron Point, and will extend for several miles in all directions from that place. The telephone instruments will all be of the latest type.

UNIONTOWN, PA.—The Tristate Telephone Company will begin shortly the construction of the line from Uniontown to Brownsville. The line is twelve miles long and will be finished in six weeks. No toll will be charged on the line between the two cities

nor to other parts of Fayette County. The direct line of the Tri-state company from Connellsville to Baltimore has also been completed.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has re-elected as directors E. G. Bigelow, F. H. Whitcomb, Charles Ray, Ira B. Smith and Alonzo Burt, all of Milwaukee, and the following from Boston: F. Fish, John Balch, Phillip Dexter, W. S. Hutchinson, H. J. Pettingill and Thomas Sherwin.

DOWNEY, CAL.—The Home Telephone Company has completed the building of its system in Downey, and is working on the connections with Rivera, Clearwater and Norwalk. The Downey office will be central for the neighboring country. Seven carloads of material have been ordered to complete the work.

ST. PAUL, MINN.—The Torah Telephone and Improvement Company, of Torah, Minn., has filed articles of incorporation. J. J. Ahnman, F. Wurst and R. T. Zemple, all of Torah, are the incorporators. The company will furnish telephone service to Richmond, and will also install an electric light plant in the town.

HANNIBAL, MO.—The Missouri & Kansas Telephone Company has accepted the ordinance passed by the Hannibal city council, granting the company a franchise for an exchange in that city. The franchise is for twenty years. The city is to receive two and one-half per cent of the company's gross receipts annually.

CONCORD, MICH.—At a meeting of the Concord telephone system the following officers were elected for the following year: trustees, Edward Ford, Albert Hubbard, Charles W. Dart, John C. Root and John H. Magel. The trustees elected Edward Ford, president; Albert Hubbard, secretary, and John C. Root, treasurer.

SALT LAKE CITY, UTAH—The Pacific States Telephone Company announces its intention of building east from Reno to the Utah state line within the next few months, connecting with the lines of the Rocky Mountain Bell Company, of Utah. The line between Reno and Ogden will be 400 miles, and the work of construction will not occupy over two months.

OBITUARY NOTICES.

MR. JOHN CAMPBELL, manager of the power-house of the Interborough Rapid Transit Company at Fifty-ninth street, New York city, died suddenly on the evening of March 18.

MR. THOMAS J. McTIGHE, a veteran inventor and promoter of electrical and mechanical apparatus, died suddenly at Salisbury, N. C., on Friday, March 24. He had been failing in health for some time. He was remarkably versatile in invention, and in the earlier days of electrical engineering contributed much to the advancement of the art. His late residence was at 2012 Cropsey avenue, Bensonhurst, Brooklyn, and he was buried at Greenport, Pa., on Tuesday, March 28.

MR. CHARLES H. SEWALL, of 1964 Seventh avenue, New York city, son of Dr. Samuel G. Sewall, died on Sunday, March 26, aged fifty-eight years. His death was followed on Monday by that of his wife, Jennie Hoover Sewall, aged fifty-nine years. Mr. Sewall was born in Skowhegan, Me., and was well known in telegraph and electrical circles. He acquired the printers' trade in his early years, and was a compositor on the Lewiston, Me., *Journal;* afterward he became a telegrapher serving in the Civil War, and was manager of the International Telegraph Company at Portland, Me., and Boston, Mass. In 1878 he became manager of the Atlantic & Pacific Telegraph Company at Albany, N. Y., and established there one of the first telephone exchanges, operating it upon the message-rate plan, the first exchange, it is believed, to be so operated. Mr. Sewall was also, as a member of the firm of Pope, Sewall & Company, instrumental in the organization of the Citizens' Illuminating Company, of Brooklyn, and through it the introduction of central station lighting into Brooklyn. He was for a number of years superintendent of the American District Telegraph Company in New York city. Mr. Sewall was the author of several books on telephony and wireless telegraphy. A father, son and daughter survive Mr. and Mrs. Sewall.

DR. ELMER HEWITT CAPEN, president of Tufts College, died on the morning of March 22. President Capen would have completed thirty years as head of Tufts College next June, having been elected on March 13, 1875, and inaugurated on June 3 following. President Capen was responsible for what is probably one of the most remarkable growths of a college institution in the history of education. From what would now be considered a small academy with a theological seminary attached Tufts College grew during President Capen's administration into a flourishing university—one of the great educational institutions of the land. With all his work as an administrator President Capen found a great deal of time for actual classroom work. He taught ethics and political economy for many years, and also the ancient and international law. Tufts College was the first New England college to substitute modern languages for Greek as an admission requirement, and to omit Greek as an essential to the degree of A. B. Likewise, this college took the lead in granting degrees upon completion of a definite number of term hours, rather than on the length of time spent in college. During Dr. Capen's administration Tufts was the first American college (in 1882) to offer a course in electrical engineering.

MR. CHARLES C. WARREN, president of the Warren Electric Manufacturing Company, Sandusky, Ohio, died on Wednesday morning, March 21. Mr. Warren was one of the pioneers in electric railway development, and for many years was a leading figure in the electrical world. Mr. Warren began his personal business career in Michigan as a merchant, serving for a time as cashier of a national bank, and subsequently becoming the founder and proprietor of what afterward developed into the Woolson Spice Company, of Toledo. He was the Chicago manager of extensive eastern electrical interests for some years before he went to Sandusky, Ohio. His first business enterprise in Sandusky was the purchase of the old Rockwell Manufacturing Company, formerly known as the Barney & Kilby plant. In its place was established the Warren Electric Manufacturing Company. Of this company Mr. Warren was president until his death. Mr. Warren in his business relations always took a peculiar interest in his employés and associates. In his administration of the affairs of the company he was untiring in his efforts to improve the situation of all whom he gathered about him. Socially he was a man of excellent qualities, and had a wide range of acquaintances and friends throughout the country. He was one of the leading promoters and active members of the interlake yacht clubs, and at the time of his death held the office of commodore. He was a member of the Men's Literary Club, of Sandusky, and took a faithful part in the upbuilding of this association. He was a freemason and a member of the Order of Elks. His death is a serious loss to the city of Sandusky and to those who have worked with him and known him for so long a time.

MR. CHARLES C. WARREN.

LEGAL NOTE.

INCANDESCENT LAMP SUITS—The General Electric Company has brought suits in the United States Circuit Court for the Southern District of New York against the Jaeger Miniature Lamp Manufacturing Company, alleging infringement of patent to H. J. Jaeger, on dental incandescent electric lamps, No. 692,294; and against the Kimball Electric Construction Company in the same court, for selling lamps manufactured by the Germania Electric Lamp Company, alleging infringement of Branin patent No. 532,760. Bills were filed on March 9. The Edison Electric Light Company had commenced suits, under date of March 13, against the Elmwood Mills, Providence, R. I., in the United States Circuit Court for the District of Rhode Island, and against the Electric Contract Company in the United States Circuit Court for the Southern District of New York, for alleged infringement of patent to Edison, numbered 544,530.

PERSONAL MENTION.

MR. C. W. TAGGARD, of Middletown, Ct., has been appointed superintendent of the new municipal electric lighting plant at Burlington, Vt.

MR. M. J. FRENCH, roadmaster of the Rapid Transit Railway, of Syracuse, N. Y., has resigned to become engineer for the Utica & Mohawk Valley Railway Company. His headquarters will be at Utica, N. Y.

MR. EDGAR W. DENNISON, who was for thirteen years in the employ of the New York & New Jersey Telephone Company, in New Jersey, has been made secretary of the Edison Manufacturing Company, Edison Phonograph Works, National Phonograph Company and Bates Manufacturing Company.

MR. LOUIS J. AUERBACHER, engineer for the Sarco Company, New York city, sailed on March 25 on the steamship Minnetonka for London. Mr. Auerbacher will make a long trip in the United Kingdom and the Continent, visiting all the prominent cities and making a careful study of all electrical installations.

COMMANDER R. E. PEARY, the Arctic explorer, gave an illustrated lecture at the Catholic Club, New York city, on March 19. He outlined the plans of his coming trip in search of the North Pole, and told of his expectations. One of the principal features of these plans will be the establishment of wireless telegraph stations along his course to the north. The new ship which Commander Peary will use is to be equipped with wireless apparatus, so that he may order supplies from some northern port. Wireless stations will be established at Cape York and Cape Sabine.

ENGINEERING SOCIETIES.

AMERICAN ELECTROCHEMICAL SOCIETY—The New York section of the American Electrochemical Society held the first of its social meetings on Saturday evening, March 25, at the Chemists' Club, New York city. Dr. P. L. T. Héroult, of France, was the guest of the evening.

ENGINEERS' CLUB, OF ST. LOUIS—The next meeting of the Engineers' Club, of St. Louis, will be held on Wednesday evening, April 5, at the club-rooms, 3817 Olive street, St. Louis, Mo., at 8.15 P. M. Mr. E. G. Helm will deliver a lecture on "The Levee and Drainage Problem of the American Bottoms."

LECTURES BEFORE THE ELECTRICAL ENGINEERING SOCIETY OF COLUMBIA UNIVERSITY, NEW YORK CITY—The following programme of lectures before the Electrical Engineering Society of Columbia University, New York city, has been announced: April 5, "Elevators," by W. W. Lighthipe; April 18, "Alternating-Current Railways," by J. H. Hallberg; May 3, "The Storage Battery," by F. J. White; May 17, "Electrochemical Industries," by Professor C. F. Chandler. There will also be a lecture on central stations, by H. G. Stott, at a date to be announced later.

INSTITUTION OF ELECTRICAL ENGINEERS, OF GREAT BRITAIN—The Journal of the Institution of Electrical Engineers, of Great Britain, for February, 1905, contains an interesting paper upon "Hydrodynamical and Electromagnetic Investigations Regarding the Magnetic Flux Distribution in Toothed-Core Armatures," by H. S. Hele-Shaw, Alfred Hay and P. H. Howell; a paper entitled "Studies in Magnetic Testing," by G. F. C. Searle, and a paper entitled "The Use of Iron in Alternating-Current Instruments," by W. E. Sumpner. This issue also contains the report to the council on the International Electrical Congress, at St. Louis, and the presidential address of B. J. Arnold, which was delivered at the joint meeting of the American Institute of Electrical Engineers and the Institution of Electrical Engineers, of Great Britain. There are given, as well, the discussions on the various papers noted above.

ELECTRICAL SECURITIES.

While the general average of prices is well below the high level for the year, there has been so much of a recovery from the reactionary proceedings of the past two weeks that in no quarter is there heard a sentiment which could be interpreted as apprehensive of future development. The reactionary development, as has been noted before, was brought about by conditions which were logical in the extreme. Unattended by news influence of any importance, certain manipulators forced prices down to a point from which a healthy start can again be made. Reports of large current and prospective earnings will aid materially in upholding the value of all the prominent industrials. It is freely predicted that a bull movement will be under way even before a full realization of the effects of the temporary reaction. As to the general trade or industrial outlook, further activity and expansion are looked for. Railroad earnings reflect increased traffic, and this would seem to indicate a much larger production on the part of every branch of trade.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MARCH 25.

New York:	*Closing.*
Brooklyn Rapid Transit	67⅜
Consolidated Gas	208
General Electric	187
Interborough Rapid Transit	209¾
Kings County Electric	200
Manhattan Elevated	168½
Metropolitan Street Railway	122½
New York & New Jersey Telephone	171
Westinghouse Manufacturing Company	190

Directors of the Westinghouse Electric and Manufacturing Company have declared the regular quarterly dividend of 2½ per cent on the preferred and the assenting and non-assenting stocks, payable April 10.

Boston:	*Closing.*
American Telephone and Telegraph	144¼
Edison Electric Illuminating	254
Massachusetts Electric	66
New England Telephone	136
Western Telephone and Telegraph preferred	100

The American Telephone and Telegraph Company announces that, under an agreement with the trustee, the principal and interest of the 4 per cent collateral trust bond of the company, due in 1929, will, at the option of the holder, be payable as they become due in gold coin of the United States of the present standard of weight and fineness. If desired these bonds will be stamped accordingly on presentation to the Old Colony Trust Company, Boston, Mass., on or after May 1, 1905.

The Western Telephone and Telegraph Company has issued its annual report for the year ending January 31 as follows: total receipts, $1,408,215; expenses, interest, taxes, $533,124, making the net revenue $875,091; dividends, $800,000, leaving a surplus of $75,091, as compared with $59,630 in 1904, and $33,849 in 1903. The business of the companies in which the Western Telephone and Telegraph Company is interested, and from which its revenues are derived, has shown continued improvement over that of previous years. The number of exchanges operated by these companies at the end of 1904 was 325, and the stations connected with these exchanges numbered 149,431, an increase during the year of 17,094. The expenditures within the year for the extension of various properties have been $1,739,271. At the annual meeting of the company directors were reelected.

Philadelphia:	*Closing.*
Electric Company of America	11¾
Electric Storage Battery common	83
Electric Storage Battery preferred	83
Philadelphia Electric	10¾
Philadelphia Rapid Transit	30¾
United Gas Improvement	116⅜

Electric Storage Battery directors have declared the regular quarterly dividends of 1¼ per cent, both on the common and preferred stocks, payable April 1.

Mr. Henry W. Phipps, of Pittsburg, has been elected a director of the Philadelphia Rapid Transit Company to take the place of Michael Murphy, resigned.

Chicago:	*Closing.*
Chicago Telephone	141
Chicago Edison Light	169
Metropolitan Elevated preferred	64
National Carbon common	45
National Carbon preferred	114
Union Traction common	10½
Union Traction preferred	39

Northwestern Elevated has paid to the city of Chicago a check for $15,248.83, as 10 per cent of the gross receipts of the Union Loop during the six months ended December 31, 1904. The check for the same period of 1903 was $16,511.

NEW INCORPORATIONS.

WINDHAM, OHIO—Windham Telephone Company. $10,000.

ALBEMARLE, N. C.—Lucas Telephone Company. $10,000.

LINCOLN, NEB.—Staplehurst Telephone Company. $5,000.

LAKE CITY, MINN.—Dwelle Telephone Company. $100,000.

DES MOINES, IOWA—Calumet Telephone Company. $1,000.

WILMINGTON, DEL.—Delaware Interurban Railway Company. $500,000.

LINCOLN, ILL.—Lincoln & Mt. Pulaski Interurban Railway Company. $25,000.

CHICAGO, ILL.—Globe Light and Heat Company. Decreased from $500,000 to $50,000.

CLEVELAND, OHIO—Brilliant Electric Company. Increased from $75,000 to $125,000.

INDIANAPOLIS, IND.—Indianapolis & Cincinnati Traction Company. Increased to $2,000,000.

EAST PALESTINE, OHIO—Unity Telephone Company. $8,000. Incorporators: J. F. Johnson and others.

ALBANY, N. Y.—Long Island Central Telephone and Telegraph Company. Increased from $5,000 to $100,000.

BRUCE, ILL.—Bruce Mutual Telephone Company. $2,500. Incorporators: C. C. Luttrell, J. W. West, F. E. Bundy.

WAUSAU, WIS.—Wisconsin River Traction Company. $30,000. Incorporators: Neal Brown, G. D. Jones and Carl Mathie.

ANACONDA, MONT.—Silver Bow Electric Company. $5,000. Directors: Eugene Carroll, Frank H. Miles and A. G. Elerick.

FORT RITNER, IND.—Fort Ritner Telephone Company. $486. Incorporators: E. C. Wicker, W. A. Holland, Thos. A. Holland.

APPLETON, ME.—West Appleton Telephone Company. $10,000. Incorporators: A. Millett, Searsmont; C. R. Bartlett, Appleton.

DECATUR, ILL.—Consumers' Electric Company. $50,000. Incorporators: W. M. Bering, Charles S. Needham and James M. Gray.

BUTLER, IND.—Toledo, Fort Wayne & Chicago Railroad Company. $10,000. Incorporators: G. E. Cummings, John White, J. S. Clark.

CHARLESTON, ILL.—Charleston Illuminating Company. $1,000. Incorporators: George M. Sefton, Flavien Mason, E. C. Jenks, J. C. Brooks, Eli Huron.

SIOUX CITY, IOWA—Bronson Telephone Company. $5,000. Incorporators: M. G. Smith, H. H. Onstot, D. B. Semple, D. D. Law and George W. Elliott.

WEST TERRE HAUTE, IND.—Farmers and Merchants' Mutual Telephone Company. $5,000. Incorporators: W. F. Tiffin, Jas. H. Davis, M. T. Goodman.

GREENVILLE, S. C.—Saluda River Power Company. $300,000. Incorporators: Lewis W. Parker, A. G. Furman, J. I. Westervelt and H. J. Haynsworth.

JERSEY CITY, N. J.—The Interurban Electric Construction Company. $125,000. Incorporators: J. J. Reed, De Witt V. D. Reilly and K. K. McLaren.

ALBANY, N. Y.—New York Independent Telephone Company. $50,000. Incorporators: Otho S. Lee, Jr., James M. Woods, H. S. Gould, all of New York city.

COLUMBUS, OHIO—Montgomery County Electric Company. $100,000. Incorporators: Robert P. Nevin, Fred A. Funkhouser, F. G. Withoff, R. R. Knowles and W. R. Craven.

SOUTH McALESTER, I. T.—Choctaw Electric Company. $150,000. Officers: A. E. Pierce, president; C. G. Wehrley, vice-president; M. M. Lindley, secretary; A. W. Thomas, treasurer.

MEMPHIS, TENN.—The Pine Bluff & Southern Railway. To build a line from Pine Bluff, Ark., through Lincoln and Jefferson counties to Star City, a distance of thirty miles. $400,000.

OCEAN PARK, CAL.—Citizens' Gas and Electric Company. $7,500. Officers: Frank E. Bundy, president; A. E. Barke, vice-president; A. E. Robinson, treasurer, and F. C. Lamb, secretary.

LONDON, KY.—Cumberland River Telephone Company. To construct lines from Barbourville, Ky., to Keely, Tenn., *via* Williamsburg, Ky. $5,000. President, John Woodward; secretary and treasurer, L. R. Benjamin.

CRENSHAW, ALA.—Luverne Electric Light and Water Company. $10,000. Incorporators: J. R. Horn, R. G. Reddoch, J. O. Sentell, E. O. Bishop, J. M. Cody, T. W. Shows, F. M. T. Tankersley, T. I. Morgan and B. R. Bricken.

ALBANY, N. Y.—Robinson Telephone Company. To operate in St. Lawrence and Franklin counties. $10,000. Directors: T. J. Robinson, of Potsdam; W. F. Robinson, of Addison, Vt., and Lindley Robinson, of Crary's Mills.

SANTA FE, N. M.—The Rio Grande Valley Electric Railway. To build an electric line sixty-five miles long from El Paso, Tex., to the mining camp of Organ, in Dona Ana County, *via* Las Cruces, Dona Ana and Anthony. $1,000,000.

WHEELING, W. VA.—The Mannington Light and Power Company. To construct and operate an electric railway between Fairmont and Mannington. $100,000. Incorporators: W. H. Furbee, J. M. Barrack, F. W. Batlett, George W. Bowers and L. S. Schwenk, all of Mannington.

FARIBAULT, MINN.—The Rice County Rural Telephone Company. $100,000. Officers: A. G. Chase, president; Isabella G. Chase, vice-president; W. T. Mollison, secretary and treasurer; W. T. Mollison, Cora B. Mollison, Isabella G. Chase, Catherine G. Chase and A. G. Chase, directors.

ALBANY, N. Y.—Corry, Findlay Lake & Northeast Railway. To operate an electric road, sixteen miles long, in Chautauqua County, on the border line between New York and Pennsylvania. $130,000. Directors: Charles P. Northrup, of Warren; M. H. Raymond and A. L. Bush, of Corry, Pa.; Ross Knight, of Westfield, N. Y.

ALBANY, N. Y.—The Chemung Valley Traction Company. To operate a street railway line eighteen and one-half miles long, from Elmira to Waverly. $700,000. Directors: E. E. Buchanan, Boyd McDowell, George McCann, George H. Davidson, J. E. Rawlins, J. Henry Clark and Fred D. Herrick, of Elmira, and J. E. Ford and P. L. Lang, of Waverly.

PERTH AMBOY, N. J.—Citizens' Light, Heat and Power Company. $125,000. Incorporators: Jacob Goldsmith, Fred J. Cox, John K. Sheehy, Louis Briegs, Max Goldberger, Edward M. Kelly, Ambrose P. Kenedy, George F. Reynolds, Clarence Sexton, Henry McCullough, C. D. Boynton, Nathan Roth, Jacob Goldberger, Barnet Goldman, Peter Floersch, John P. Holm and Jesse Sickles.

ALBANY, N. Y.—The Bronx, Yonkers & White Plains Railway Company. To operate an electric railroad line eleven miles long from Yonkers to White Plains, there to connect with the Harlem division of the New York Central & Hudson River Railroad Company. $110,000. Directors: W. H. Whittaker, J. H. Matthews, G. A. Matthews and W. C. Shires, of New York city; F. S. Fisher, E. M. Booth, Patrick McCann, Nathan Fernbacher and I. M. Hunt, of White Plains.

LITTLE ROCK, ARK.—The Little Rock & Hot Springs Electric Railway Company. $2,000,000. Officers: president, C. J. Kramer, Little Rock; first vice-president, L. Garrett, Springfield, Mo.; second vice-president, A. S. Blodgett, Springfield, Mo.; secretary, J. C. Marshall, Little Rock; treasurer, George W. Rogers, Little Rock. Directors: Max Mayer, W. W. Dickinson, W. S. Mitchell, C. L. Ketcham, P. M. Pierce, H. Murdock, M. D. Welch and B. Bowman and the officers.

ALBANY, N. Y.—Electric Bond and Share Company, of Schenectady. To conduct a railway, electric, gas and hydraulic equipment business. $4,000,000. Directors: Marsden J. Perry, of Providence, R. I.; Philip L. Saltonstall and Robert Treat Paine, 2d, of Boston; Jacob K. Newman, of New Orleans; Charles A. Coffin, Charles W. Wetmore, Alden M. Young, Sidney Z. Mitchell, S. Redding Bertron, William M. Barnum and Louis B. Stanton, of New York city; Homer B. Johnson, of Cleveland; William B. McKinley, of Chicago; Hinsdill Parsons, of Schenectady; William H. Alms, of Cincinnati, and Dwight W. Morrow and Graham Sumner, of Englewood, N. J.

ELECTRIC RAILWAYS.

GULFPORT, MISS.—It has been decided to build an electric road to connect Gulfport with Biloxi.

DOVER, N. J.—The trolley line from Camden to Haddonfield will be extended to Clementon shortly, and eventually to Berlin.

KINGSTON, ONT.—The Kingston Street Railway Company has passed into the hands of the bondholders, who held a mortgage for over $150,000.

LOCKHART, TEX.—The business men of Lockhart have taken the initial steps toward the construction of an interurban route to intersect the San Marcos route.

SPRINGFIELD, OHIO—Surveyors have begun work on a traction line it is proposed to build from Springfield to Lima by way of Catawba, Mechanicsburg and Marysville.

OAKLAND, CAL.—A contract has been granted by the supervisors of Bakersfield for the completion of the Kern River road between Bakersfield and Hot Springs Valley for $21,000.

BOLIVAR, N. Y.—Wellsville capitalists are talking of building a trolley line from Wellsville to Bolivar, a distance of fourteen miles. It is proposed to begin the work of construction early this spring. The cost of building the line is estimated at $10,000 per mile.

PARIS, ILL.—The Edgar County board of supervisors has granted the Paris Traction Company a right-of-way on the Chicago road, north from the city limits to Reservoir Park. A franchise having already been secured from the city, the work will proceed as soon as the material can be secured.

ST. LOUIS, MO.—The Sedalia Transit Company, successor to the Sedalia Electric and Light Company, is letting contracts for new rails and several extensions. The property was recently merged with the Sedalia Water, Light and Gas Company, and is now controlled by Horace Rumsey, Joseph Clark and other St. Louisans.

FINDLAY, OHIO—Jerry Reeves, of Canal Dover, chief owner of the Toledo, Findlay & Fostoria electric line, has purchased ties and steel for the construction of a branch line from Fostoria to Pemberville, a distance of seventeen miles, and a branch from Pemberville to Bradner to Prairie Depot, a distance of two and one-half miles.

ST. LOUIS, MO.—The Hillsboro, Ill., city council has granted to the St. Louis & Northeastern Railway Company a fifty-year franchise for the construction and operation of an electric railway over several streets in Hillsboro. The company is preparing to build an interurban line to Litchfield, and the line will ultimately extend to East St. Louis.

SOUTHINGTON, CT.—The contract for building four miles of trolley road, connecting the Meriden, Southington & Compounce Tramway's lines at Milldale and the lines of the Cheshire Street Railway Company at Cheshire, has been let to George J. Roberts, of Philadelphia. The terms of the contract call for the completion of the work by July 15 next.

ZANESVILLE, OHIO—The Muskingum, Coshocton & Tuscarawa Electric Railway Company has been incorporated and organized with John J. Adams, president, James R. Alexander, secretary and treasurer, and Henry I. Buell, chief engineer. The company proposes to construct an electric railway from Zanesville through Coshocton to New Philadelphia.

GENEVA, N. Y.—The Rochester & Eastern Company has decided to build a supplementary electric road between Rochester and Geneva. It is said work will be begun as soon as weather permits. The plans are to build a new line from Canandaigua to Geneva, passing through Shortsville, Clifton Springs and Phelps. At Hathaways Corners the new line will connect with the present one.

POTTSVILLE, PA.—The Tamaqua & Pottsville Electric Railroad Company has been granted franchises for building two branches through the town of St. Clair. This company will, during April, start work on a line from Pottsville, through St. Clair, Frackville and Shenandoah. It is controlled by the Pottsville Union Traction Company, which has a $3,000,000 investment in Schuylkill County.

WALLA WALLA, WASH.—The Walla Walla city council has granted to Edwin S. Isaacs and his successors a franchise for an electric street car system within the corporate limits of the city. The time of the franchise is twenty-five years and provides that the road must be constructed and cars operated in the business district on or before May 31, 1906, otherwise the franchise will be null and void.

MONTGOMERY, ALA.—A controlling interest in the Montgomery Traction Company, which was recently placed in the hands of a receiver, and which operates about ten miles of street railway track and a summer park at Montgomery, has been sold to Philadelphia capitalists. The purchasers also assume all the bonded indebtedness, amounting to $318,000. It is announced that they will improve the present system in the immediate future.

JACKSON, MISS.—The charter of the Durant-Lexington Electric Railway has been approved. The capital stock is placed at $300,000, and the company is to build an electric line from Durant to Lexington, both points being in Holmes County. Construction on the line is to be begun within thirty days. The company, after establishing the connection between the two points named, will extend the road so as to take in other towns in the surrounding territory.

WORCESTER, MASS.—John M. and C. J. Buckley have been awarded a contract to erect the power plant at Lyons, N. Y., for the Rochester, Syracuse & Eastern Railway Company, at a cost of $60,000, the structure to be roofed by July 1. Work will begin April 3. This is part of contracts totaling $300,000 for the Rochester-Lyons division of the electric trolley road to be completed November 15. The system is seventy miles long and parallels the New York Central.

SPEARFISH, S. D.—A mass meeting of business men has been held for the purpose of considering the question of building an electric line to connect Spearfish with Belle Fourche, Deadwood and Lead. It is proposed to raise the money by popular subscription, and it is generally believed that the enterprise will be a success. It is intended to go to the northern hills by way of Belle Fourche. The enterprise is receiving support from the business men of Lead and Deadwood.

AUSTIN, TEX.—The charter of the Houston-Galveston Electric Railway Company, having a capital stock of $1,350,000, has been filed in the secretary of state's office. The company is formed for the purpose of building and operating an electric railway to run between Houston and Galveston, a distance of fifty-four miles. The principal office of the company is at Houston. The board of directors are Frank Pread, William Johnston, R. M. Johnston, George L. Horton and A. D. Trotter, all of Houston.

SOUTH BEND, IND.—At a meeting of the board of directors of the Indianapolis, Logansport & South Bend Traction Railroad Company it was decided to increase the capital stock of the corporation to $100,000. Active operations will begin in the spring as soon as the weather will permit and the work will be pushed to early completion. The company will build from Logansport to South Bend, to connect with a line running to Indianapolis. Surveys have been made and all arrangements perfected for installing the line.

LEXINGTON, OKLA.—Ground has been broken on the Oklahoma City, Lexington & Sulphur Springs Electric Railway, which was projected last summer from Oklahoma City, Okla., to Sulphur Springs, in Indian Territory, a distance of eighty-five miles. It is understood that the grading will be pushed north to Oklahoma City, and it is reported that the road will be in operation between Lexington and Oklahoma City within the next six months. This line of railroad, when completed, will afford an outlet to the fruit growers of Southern Oklahoma.

LEXINGTON, KY.—The Central Kentucky Traction Company has been incorporated, capitalized at $200,000 and backed entirely by Lexington capital. The new company will take over all the holdings of the Fayette Interurban and Bluegrass Consolidated Traction companies. Work on the Lexington-Versailles line will be commenced as soon as the weather will permit, and pushed to completion before the other roads are built. The incorporators of the new company are: Louis Des Cognetts, president of the Lexington Railway Company; D. F. Frazee, J. W. Rodes, Peter G. Powell, W. W. Bain and T. P. Young.

INDUSTRIAL ITEMS.

PASS & SEYMOUR, INCORPORATED, Solvay, N. Y., recently announced in a circular letter that a reduction in the price of "Little Gem" rosettes would be inaugurated, and that shipments from branch offices would be at the same price as in the past.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, Ill., is equipping a number of the war department divisions with switchboard and telephone apparatus. A recent shipment to Washington included two fifty-line local battery switchboards.

THE ECCLESTON LUMBER COMPANY, New York city, on April 1 opens its new agency at 44 and 46 Broadway. This company supplies ties and poles in southern cedar and juniper. Orders of any magnitude can be undertaken, and prompt shipments guaranteed.

THE ELECTRICAL APPLIANCE COMPANY, Cincinnati, Ohio, announces that its plant and business pertaining to interior telephones, and all business other than rectifiers, were transferred to the Churcher Electric and Manufacturing Company on March 11, 1905.

THE AMERICAN ELECTRICAL SUPPLY COMPANY, 83-87 Fifth avenue, Chicago, Ill., has secured the sole selling agency for the "Newgard" receptacle. This company has completed a new bulletin descriptive of this material, and will be pleased to mail full information upon application.

ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., U. S. A., will be represented hereafter in West Australia by Mr. F. R. Perrot, and in New Zealand by the firm of John Chambers & Son, Limited. Mr. Perrot's headquarters are at Perth, West Australia, and those of John Chambers & Son, Limited, are at Auckland.

THE L. B. ALLEN COMPANY, INCORPORATED, Chicago, Ill., is mailing to the trade a novel folder, calling attention to its fluid flux made with Allen soldering salts. This soldering salt is claimed by the manufacturer to save time and solder, and to ensure a clean, strong and perfect joint. Full information will be sent upon request.

THE SWITCHBOARD MANUFACTURING COMPANY, New York city, has moved to greatly increased quarters at Fifty-eighth street and Eleventh avenue. This company will now have all the manufacturing facilities necessary to meet the increased demand for its lines of distributing apparatus, in the way of switchboards and switchboard equipments.

THE WILLIAMS ELECTRIC MACHINE COMPANY, Akron, Ohio, reports a large number of sales during the past month of its magnetic clutches. Among the purchasers of this apparatus were a state university, a brass rolling mill, an engraving company, and a large clay manufacturing company, showing the diversified application of these clutches.

THE TRAY PLATE BATTERY COMPANY, Binghamton, N. Y., advises that its business has increased to such an extent that it has become necessary to open an office at No. 39 Cortlandt street, New York city, for the care of its sales. In the future the sales department will be in charge of Mr. Harry B. Oakman, who is well known throughout the electrical engineering fields, and especially the storage battery field.

THE NATIONAL ELECTRIC COMPANY, Milwaukee, Wis., is distributing bulletin No. 2 of its electrical catechism. This number takes up the determination of the units, and an explanation of Ohm's law. This series of bulletins should be preserved, as the catechism is intended to become a handbook of valuable information to engineers. Those on the regular mailing list of the National Electric Company will receive a cover for these issues.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., will be pleased to send the April number of "Graphite" to any one interested in this material. This paper is issued in the interest of Dixon's graphite productions, for the purpose of establishing a better understanding in regard to the different forms of graphite and their respective uses. The April number is especially interesting, containing, as it does, so many illustrations of structures of various natures which have been protected with different graphite materials. The issue is replete with carefully worked illustrations, and the text is illuminating and convincing at the same time.

THE STERLING ELECTRICAL MANUFACTURING COMPANY, Warren, Ohio, has just renewed arrangements with the Stuart-Howland Company, of Boston, whereby the latter company retains the exclusive agency in New England for the "Sterling" and "Sterling Special" types of incandescent lamps. The sales of incandescent lamps by the Stuart-Howland Company for the previous year aggregated over 200,000 incandescent lamps, and it is believed that these figures will be exceeded during the coming twelve months.

FRANK B. COOK, Chicago, Ill., has received a number of orders recently for complete protector equipment for telephone exchanges, both inside and out. Among these are the Red Wing Telephone Company, Red Wing, Minn., 900 pairs of No. 8 protectors for switchboard protection and thirty-five type S. M. cable terminals for outside protection; the Seward Telephone Company, Seward, Neb., 200 pairs of No. 8 protectors and eighteen pole cable terminals, type S. W.; Williamsport Telephone Company, Williamsport, Ind., 520 pairs No. 8 protectors and twenty type S. W. pole cable terminals; Fairbury Telephone Company, Fairbury, Neb., twenty type S. W. terminals for outside protection.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has published the Exide battery instruction book for 1905. This instruction book gives a description of the battery parts, directions for unpacking, charging connections, charging batteries and vehicles, a table giving rates of charging current, and voltages when charging. There is, in addition to all this, a large amount of information covering all conditions under which storage batteries will need attention in ordinary service. The condensed rules for the proper care of batteries are well thought out, and are a ready reference to full information upon this matter. In addition to the text there are illustrations of the parts of the battery, with views showing the proper method of connecting up battery sets.

THE STANDARD UNDERGROUND CABLE COMPANY, Pittsburg, Pa., announces that on account of the general growth of its business on the Pacific coast it has decided to discontinue all agency arrangements for the sale of its products, and on April 1 will open its new offices in the Rialto Building, San Francisco, Cal., with Mr. A. B. Saurman as manager for the Pacific coast territory. This territory includes Washington, Oregon, Idaho, California, Nevada, Arizona, British Columbia, Alaska and the Hawaiian Islands. Mr. Saurman has, in turn, been connected with the Standard Underground Cable Company in both construction and sales departments at Philadelphia and New York, and for several years was manager of the Boston office. For the past two years his position has been that of manager of the Pacific coast sales department. The Standard Underground Cable Company expects, at an early date, to make announcement of the location and personnel of subsales offices at Los Angeles and Portland. The company reports that its factory at Oakland, Cal., has been unusually busy during the past six months, and that the future on the coast points to its continued activity.

DODGE & DAY, Nicetown, Philadelphia, Pa., have issued bulletin No. 175, entitled "A Modern Industrial Plant." Dodge & Day have made a study of economics as applied to manufacturing establishments, and the engineering work of their mechanical, electrical and architectural departments ensures harmony of building and equipment. The bulletin contains a graphical chart of their organization, and gives illustrations of their methods. It indicates that they are prepared to lay out, construct, equip and systematize new plants, as well as modernize old ones. Dodge & Day were commissioned some time since by the Lehigh Coal and Navigation Company to take charge of its extensive shop improvements at Lansford, Pa., including new buildings, machine tools and electrical equipment. They have been further commissioned to take charge of the erection of a new centrally located power plant. This plant will provide current for the shops of the Tamaqua & Lansford Street Railway, and electrical equipment will be installed in the mines for pumping and transportation purposes. Mr. Herbert Clarke, engineer for the Tamaqua & Lansford Street Railway, will cooperate with Dodge & Day on the specifications for this plant.